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AUTHOR Ariew, Robert A.; Dunkel, Patricia A.
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ABSTRACT

The development of a prototype computer-assisted second language listening comprehension test is reported. The project investigated the feasibility of computer-adaptive second language listening tests using microcomputer equipment and developing model testing software. Tests for French and for English as a Second Language (ESL) were developed. The specific testing issues addressed include: (1) the use of stored digitized speech for auto-cueing, (2) the interface of graphics and text, (3) the application of the American Council on the Teaching of Foreign Languages (ACTFL) proficiency guidelines to a computer-based listening comprehension test, (4) methods of item presentation, (5) various response handling strategies, (6) minimum hardware configurations necessary for implementation, and (7) the feasibility of storing and accessing test scores and demographic data on diskette. The report contains: an overview of the resulting system; descriptions of the system's architecture, hardware configuration, and software configuration; notes on system users; information on the file and database structure; application logic for the test and design modes of the program; data on hard disk configuration; and notes on testing the system and additional enhancements. A substantial sample of ESL screens and an ESL items tape script are appended. (MSE)

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The Pennsylvania State University
Department of Speech Communication
Sparks Building
University Park
Pennsylvania, 16802

Final Report to the U. S. Department of Education

International Research and Studies Program

A PROTOTYPE FOR A COMPUTER-BASED LISTENING COMPREHENSION PROFICIENCY TEST

Robert A. Ariew & Patricia A. Dunkel (Co-Principal Investigators)

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February 10, 1989
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A Prototype for a Computer-Based

Listening Comprehension Proficiency Test

Final Report Submitted to The U.S. Department of Education

by Robert A. Ariew & Patricia A. Dunkel

The Pennsylvania State University

February 10, 1989

Introduction

In our original grant request, we proposed to design and implement a prototype Listening Comprehension Proficiency Test that might serve as a model for expansion and dissemination by national organizations. Our intent was to provide a concrete and workable prototype for foreign/second language (L2) listening comprehension tests. Our goal was not to establish an item bank or to validate test items during the conduct of the research project since such an attempt would have required resources that were beyond the scope of our request. Our investigation emphasized determining the feasibility of computer-adaptive L2 listening tests using microcomputer equipment and developing model testing software.

As part of the project, a small item pool was established from which the test items displayed to the user are chosen. The item pool was not built from tested or validated items; rather, it was based on subjective analysis, gleaned from the considerable teaching and materials design experience of the Project Investigators. The purpose of the prototype item pool is, as a result, to demonstrate the feasibility of two computer-based listening proficiency tests, one for French and one for English. The English test serves as a prototype for English as a Second Language listening tests, and as a generic model for other languages. The French test serves as an example of a listening proficiency test prototype in a foreign language,

demonstrating the feasibility of using stored digitized speech in a foreign language for audio-cueing of test items, and of displaying screens containing accents and other diacritics on the IBM PC (and compatible) screen.

Principal Objectives

The project's principal objectives were the following:

a) To develop a prototype for a computer-based Listening Comprehension Proficiency Test using commercially-available hardware.

b) To assess the feasibility of testing proficiency in listening comprehension using stored digitized speech for audio-cueing and, thereby, to demonstrate the ease of storage and retrieval of voice data in French and English, and to determine whether graphics can be interfaced with voice and with text into a seamless, easily implementable test.

c) To test the applicability of computer-based adaptive testing for the assessment of listening comprehension proficiency in a second/foreign language (L2).

d) To apply the ACTFL Guidelines to the construction of a computer-based L2 listening comprehension test.

e) To test a variety of item presentation types, and of response handling strategies.

f) To identify minimum hardware configurations necessary to implement listening proficiency tests; also, to identify additional hardware devices necessary to implement computer-based listening tests.

g) To assess the feasibility of storing and accessing test scores and demographic information from data files stored on a disk.

Activities in Support of the Investigation

In the original project proposal, we identified specific activities which were to be carried out in support of the investigation; they are as follows:

1) Hardware and software acquisition and installation.

Timeframe: October, 1987.

2) Training of personnel on the use of the hardware and software acquired.

Timeframe: October-November, 1987.

3) Consultations with the Educational Testing Service, the American Council on the Teaching of Foreign Language (ACTFL), and with Penn State's Testing Services. In addition, a consultation with the Center for Applied Linguistics was included.

Timeframe: November 1987-December, 1988.

4) Design of prototype items for French and English.

Timeframe: November 1987-April, 1988.

5) Design of item-retrieval algorithm.

Timeframe: November 1987-April, 1988.

6) Design of test screens and input strategies.

Timeframe: November 1987-April, 1988.

7) Recording of audio-cueing material.

Timeframe: January-February, 1988.

8) Second round of consultations with ACTFL and ETS.

Timeframe: February-March, 1987.

9) Preliminary testing with students at Penn State.

Timeframe: April-May, 1987.

10) Preliminary validation of test procedures.

Timeframe: May-June, 1987.

11) Preliminary validation of test results and comparisons with other results.

Timeframe: May-July, 1988.

12) Final Consultation with ACTFL.

Timeframe: July-August, 1988.

Role of Personnel

In the original proposal Ariew and Dunkel were to work as co-directors of the project at Penn State. Each was to work on devising the tests in their respective areas of expertise, with Ariew designing and implementing the French test and Dunkel constructing the ESL test. In August 1987, Ariew took a leave of absence to the University of Arizona where he had made arrangements that would permit him to continue to work on the DOE project. Although geographically separated from one another, Ariew and Dunkel fulfilled their stated collaborative commitments to the project. They remained in very frequent contact via the BITNET electronic mail system and by telephone to confer about the project. During the month of December 1987, Dunkel visited Arizona to confer with Ariew on the progress of the project, and in June 1988, Ariew travelled to Pennsylvania to confer with Dunkel on the last phases of the project. At that time, Patricia Dandonoli of ACTFL was invited to consult with the two investigators.

Accomplishments

Although the complex nature of the task of building a prototype computerized-adaptive listening comprehension test became apparent during the conduct of the investigation, all of the principal objectives set forth in the original

proposal were met by Dunkel, and or Ariew, and the activities in support of the investigation have been completed by the date of submission of the final report. Specifically, the following activities were undertaken, and the following objectives achieved:

(1) Hardware and Software Acquisition and Installation

Ariew purchased a PC compatible microcomputer, a 40 Megabyte (MB) hard disk drive, an IBM Voice Communications Adapter card and software, and a printer. Support software acquired includes DBase III Plus, a database management system, and graphics support software. Initially, two pieces of equipment did not function properly. The PC compatible microcomputer had to be returned because it was defective. It was replaced and served well during the investigation. The IBM Voice Communications Option also had to be returned for repair. Since IBM announced that the IBM Voice Communication Option would not be supported in the future, Ariew purchased another voice digitizer, the Antex VP 620E board which was also used during the investigation.

Dunkel purchased an IBM XT 286 computer, a color monitor, and Enhanced Color Graphics card, an 80 MB hard disk, an external modem, a memory expansion board and chips, a 360K floppy disk drive, a PC Mouse and software, DBASE III Plus, DBASE C Library, DBASE Graphics Library, MicroSoft C Compiler, MicroSoft Assembler, PC Tools Storyboard (subsequently found to be of little use to the project), PC-Paint, PC Paint Fonts and Pictures. (See pages 8 and 15 of Dunkel's technical report in Appendix 1, for an inventory and description of the hardware acquired and the software utilized.)

(2) Training of Personnel on the Use of the Hardware/Software Acquired

Dunkel hired Gary Morrison, a graduate student in the Department of Computer Science at Penn State to be the project's ESL software designer and programmer. He began in late October and by December 1987, he had designed the initial file structure and application logic for the test. Morrison continued to make refinements in the application design until the final System Design was set in the summer of 1988. When Morrison interrupted his work at Penn State to take a summer internship at International Business Machines corporation, Anil Patankar was hired to help with the programming. (Refer to Appendix 1 for a in-depth description of the ESL system design created by Gary Morrison.) Dunkel also hired Melissa Eliason and Gabrielle Bauer, graduate students in the Department of Speech Communication, to help transfer the speech selections into the computer and to create the screen displays of the test items. (Clip art graphics were mainly used in the project; however, it would be preferable to have a graphic artist create displays designed specifically for the individual items. Use of a scanner would also be beneficial in creating screen displays[1]

At first, Ariew encountered problems in hiring personnel. The problems arose because of his relocation to Arizona, and because of apparent difficulties in transferring funds from one institution to another. He initially was not able to hire any personnel for programming assistance and had to spend considerable amounts of time becoming familiar with the hardware and software himself. Later, grant funds were transferred, and he was able to hire two individuals to help. An upper-level undergraduate was hired for general programming duties, including coding items and integrating graphics with the screen displays. He also contacted a small

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[1] A graphic artist from Penn State's Computer-Based Education Lab will create logo screen and graphics for the prototype during the spring 1989 semester; work continues, and has continued, on the project past the stated close of the project.

software firm, Antares, in Tucson and was able to get the services of a highly-trained programmer to help with the interfacing of both the IBM Voice Communication Option and the Antex VP 620E board. (Refer to Appendix 2 for a fuller report on Ariew's software development efforts.

(3) Consultations with the Educational Testing Service, the American Council on the Teaching of Foreign Language, and with Penn State's Testing Services

Ariew was able to attend the conference of the American Council on the Teaching of Foreign Language that was held in Atlanta in November, 1987 and to meet with Patricia Dandonoli of the American Council on the Teaching of Foreign Languages (ACTFL). The preliminary meeting was very fruitful. Dandonoli provided Ariew with many details about the ACTFL reading proficiency test. This information is very pertinent to designing the listening proficiency test. Dunkel was briefed about the meeting with Dandonoli. Dunkel met with Dandonoli in late February and with Charles Stansfield of the Center for Applied Linguistics and author of **Technology and Language Testing,** at the TESOL conference in Chicago in early March. Dunkel had several meetings with Edward Marks and Robert Laughlin of Penn State University Testing Service; they provided advice on designing the algorithm for the computerized-adaptive part of the test. Both Ariew and Dunkel met with Dandonoli in State College, Pennsylvania, in June. During this meeting they discussed the design, creation, and distribution to potential users of an L2 listening comprehension test. Dandonoli briefed Dunkel and Ariew on the ACTFL project to develop a computerized-adaptive reading comprehension test.

(4) Design of Prototype Items for French and English Tests

Prototype items were designed during the Summer and early Fall. The items were not validated, but were written with the help of the ACTFL generic listening proficiency guidelines. Items to test the novice, intermediate, advanced and superior levels were written for the French (see Appendix 2 for illustrations of screen displays of test items), and items were written for the novice and intermediate levels of the English test (see Appendix 1 for illustrations of screen displays of test items). Dunkel spent a great deal of time working on the the design of the file structure and application logic of the software program (see Appendix 1).

Voice files contained a variety of audio messages varying from one-word messages to paragraph-length messages. Most messages were recorded using a tape recorder whose output was fed to the digitizing board. Messages to test higher proficiency levels were excerpted from pre-recorded interviews or radio broadcasts, and commercially available audiotapes (e.g., Dunkel & Pialorsi, 1982; Dunkel & Lim, 1985; Dunkel & Gorder, 1986).

Ariew designed test materials in French. Since French requires that various accents and special characters be shown on the display, his first task was to solve certain screen design problems. A method was devised to display French characters in several sizes and font styles. Solving the display problem necessitated extensive work with graphic display modes and, hence, involved simultaneously solving the problem of displaying graphics, such as line drawings. All text material for the test may be displayed in French, with all accents in 40 column mode as well as in 80 column mode, in regular size and double sized characters, in normal text (white on black) as well as in inverse (black on white). Graphics may be mixed with the text freely. Text may be overwritten on the graphics also. Graphics may be either

colored (with the limited number of colors available on the IBM Color Graphics Adapter display), or monochrome. Whenever text and graphics are in monochrome, they may be displayed in any one of three different colors. Special care was given to display flexibility to assure that test items could look as interesting as possible and to allow graphics to be used at any time on the displays. Screen display flexibility was deemed important since, for foreign languages, a variety of accents and special symbols must be written on the screen. In addition to a well-designed and interesting screens, all test items needed access to digitized voice files. Voice files were created using either the IBM Voice Communication Option or the Antex Digitizing Board. The files were referenced in the test item (along with any graphics files needed), and made accessible to the user. Of course, the computer on which the test is taken must be equipped with either a high-quality speaker or a set of headphones through which the audio cues are heard. In all, Ariew designed approximately thirty test items. (See Appendix 2 for illustrations of Ariew's screen displays.) The items do not comprise a real test, but serve as a catalog of item types for a future full-scale test. There were enough items, however, to allow users to see how the test would function.

Dunkel also designed more than 30 items and concentrated effort on determining item formats and contents that would be compatible with the ACTFL Listening Guidelines and Richards' (1985) Taxonomy of Listening Skills. (See Appendix 1 for illustrations of Dunkel's screens.)

(5) Design of the Retrieval Algorithm

A retrieval algorithm was designed by Ariew at the same time as test items were written. The retrieval algorithm is a necessary part of the test since it is the "switch" that determines which item will be presented to the student. The program must be "intelligent" enough to present the next item and to determine the final listening proficiency level of the user.

Ariew approached the subject in a simple way. All test items are listed by name in the main program and are categorized by proficiency level. For the purpose of the test there are nine levels of proficiency, including the sublevels specified by ACTFL. (The levels are Novice low, mid and high; Intermediate low, mid and high; Advanced and Advanced plus; Superior.) The first items displayed to the user are two intermediate-mid items. If those items are answered correctly, the user is given two intermediate-high items in a row. The user thus progresses from level to level when he or she performs well on two successive items on the same proficiency level. When either of the items at a particular proficiency level is not done successfully, the program chooses two items on a lower level (not the same items which were presented previously). When those two items are answered correctly, the test ends, and a determination of proficiency level is made. The mechanical algorithm, therefore, determines the listening proficiency level of a user by the successful completion of two items on a particular level after having failed at least one item on a higher level.

The algorithm begins with items on the Intermediate mid-level merely to avoid beginning at the novice level (which is relatively easy and unchallenging).

Ariew's algorithm, even though it is simple, is a good first attempt. Its main advantage is that it is easily implemented and easy to understand. Furthermore, it mirrors almost exactly ACTFL's procedures for oral proficiency testing. The algorithm performed well on the small item pool and on the small number of users on whom it was tried.

Dunkel also used a mechanical algorithm as a first step in the design of the test. (For a full description of the Program Logic for DOTEST.PGM [Do Test Program], see pages, 32-34 of Appendix 1.) Due to the emphasis placed on the system design and the complexity of the project, less time was spent on creation of

an appropriate algorithm to drive the computerized-adaptive aspect of Dunkel's prototype.

The testing algorithm is driven by testing rules that are provided from the DESIGN Mode portion of the application. The intent of the rule structure is to facilitate a way to tailor the selection of test questions which will not require changes in the application code. At present, the prototype is being driven by a mechanical algorithm set arbitrarily to a percentage "success/failure" rate for items undertaken. The algorithm needs further refinement and should incorporate the model of Item Response Theory (IRT) into the design of the adaptive aspect of the test (see Madsen, in press; Tung, 1986)

(6) Design of Test Screens and Input Strategies

Initial screen displays were designed in late Summer and early Fall of 1987, as were strategies to allow users to input answers; however, work is continuing on the ESL test beyond the scope of the funded research project to continue investigation of the design of screen displays.

The French Items

Because Ariew had to deal with special characters and accented letters, the task of designing screens was quite difficult (see description of display capabilities above). However, once it was feasible to display text in various sizes and styles and simultaneously to display text and color graphics, the process became feasible and it was then possible to experiment with various design strategies.

It became apparent that on the IBM graphics screen accented letters were difficult to read. For that reason, most items are displayed on a 40 column screen. At that resolution, foreign language text becomes legible. The 80 column display was essentially relegated to those screens used to display information about the test in English (the user's native language).

The test item display was also designed with three separate horizontal "zones." The first zone, the top third of the screen, is reserved for instructions, directions and examples. This top quarter of the screen is displayed first to the user who is instructed to read the screen and press a key to hear the recorded message. The bottom two lines of the screen are reserved for directions such as "Press any key to continue" or "Press any key to hear the recorded message." The middle of the display is where the user finds the multiple choices which comprise the answer. These choices are either in a graphic format, or written out. The user, after hearing the recorded message, then merely selects an appropriate answer from among those listed, or selects a graphic which is an accurate representation of the recorded message. Once an answer is entered, the student may either a) press RETURN (or ENTER) to continue, or b) change the answer and then continue.

The keyboard is the only input device used for indicating choices. In the original proposal, an alternative device, the mouse, was to be used to input answers. It was found that the particular mouse selected (a Microsoft "bus" mouse) interfered with the digitizing board and could not be used. It is possible, however, that another type of mouse (a "serial" mouse) could eventually be used to input answers. Other possible input devices are: touch sensitive screens, joysticks and trackballs.

The ESL Items

Dunkel's screen contained graphics and text, with the text created in graphics-format so that different type sizes and fonts could be utilized (e.g., Roman script). PC-Paint was used to create the screens (640 x 350 pixels and four colors). The test begins by displaying the FIRST screen which prompts the test taker to provide demographic information, such as, "How many years have you studied English?" The test taker completes the fields and presses the "ENTER" key which results in

the display of the directions in written and spoken form. An external speaker or headset can be used. After the directions have been given, the test taker will respond to a prompt by pressing any key to start the test.

The test begins with either a question, a statement, or a short monolog or dialog which is followed by another speaker who asks a question about the information just presented. After the speech portions have terminated, the list of answers the test taker has to select from is displayed on the monitor. The application then waits for the test taker to respond by typing an answer on the command line and pressing the "ENTER" key. At the initial levels of proficiency (novice-low through intermediate-low), the test taker may ask for a repetition of the question/ statement/dialog since the ACTFL Guidelines acknowledge that beginners must often ask for repetition of information from speakers. A time limit, yet to be determined, will be set for the novice and low-intermediate level listeners to complete an item. For the upper levels, no repetition will be allowed, and if the test taker does not respond after a predetermined period of time, a prompt will be displayed stating that the test taker must answer within ten seconds. If the test taker still does not answer within ten seconds, the answer is recorded as incorrect, and then the next question is displayed. Furthermore, at the bottom of every answer/question screen will be a key that can be pressed to exit the test. If the test taker presses it then a prompt will be given and the test taker must answer again correctly to exit the test; otherwise the test continues. When the test has been completed the test results will be written to the appropriate DBASE files and the LAST screen will be displayed.

The ESL form of the prototype test is divided into three main divisions: Detecting/Making Appropriate Responses to Questions Heard; Recognizing Synonymous Statements for Statements Heard; Comprehension of

Dialogs/Conversation. Within each division, the ACTFL Listening Guidelines were used to guide preparation of the items as far as possible. In addition, Richards' Taxonomy of Micro-skills in Conversational Listening were used to guide item writing (see Appendix 1 (B) for examples of screen displays). Although the ACTFL guidelines and Richards' taxonomy guided some aspects of the item writing, during preparation of the prototype items, it became eminently clear that there is a pressing need for the creation of a model that captures the essence of developmental listening proficiency, one that relates input factors (e.g., linguistic simplifications and elaborations), listening tasks, learner variables, and socio- and psycholinguistic considerations influencing information processing. The availability of such a model would be of great assistance to those engaged in the writing of listening-proficiency test items which relate to the various stages of listening comprehension development; a delineation of these stages has been suggested by the American Council of the Teaching of Foreign Languages in their Listening Proficiency Guidelines. With this realization in mind, Dunkel applied for, and was awarded, a Mellon fellowship to collaborate with Dr. Craig Chaudron of the University of Hawaii, and Dr. Grant Henning of the Educational Testing Service to design a model of second/foreign language (L2) listening comprehension proficiency that is compatible with technological testing applications. Dunkel, Chaudron, and Henning will collaborate together for a month in the summer of 1990 at the National Foreign Language Center's Institute of Advanced Studies at the Johns Hopkins University. The support provided by this fellowship will ensure that work continues on developing a framework for identifying and measuring determinants of listening comprehension proficiency in L2. The model should prove of value to future designers of computerized-adaptive tests of L2 listening comprehension proficiency.

In addition, in November 1988, Dunkel received an internal grant from the Computer-Based Education Laboratory (CBEL) of Penn State to produce additional graphics for the screen displays in the test. A graphic artist at CBEL will design and program graphics for the test to augment graphics displays already created. Work on the project will continue beyond the stated timeframe of the DOE funded project, as a result. (For a full description of the file structure of the ESL test, see Section 6 of Appendix 1).

(7) Recording of the Audio-Cueing Material.

The final stage of test item production was to record audio materials. Ariew chose to work on two separate digitizing devices, the IBM Voice Communication Option and the Antex digitizing board. This was done for two reasons: (1) IBM has announced that, since the Voice Communication Option is not compatible with the newest machines, it was going to discontinue the board. An alternative solution had to be found. (2) It was also thought that it would be advantageous for the investigator to have experience with more than one device.

Unfortunately, the two devices create incompatible files. It is not, therefore, possible to use a voice file created by one device on the other. Two separate recordings had to be made, each to be used on the device which created it. Furthermore, each device had specific quirks. The IBM Voice Communication Option has a microphone level input. This means that it is designed for the microphone to be directly connected to the board. That arrangement was prone to hum and spurious noises stemming from the microcomputer. Better quality recordings were made by making the recordings on cassette tape and then transferring them to the board. Noise levels were reduced and overall quality was improved. However, because of the sensitivity of the microphone level input, adjusting sound level on the cassette was critical.

The Antex board is about half the price of the IBM Voice Communication Option (which includes many features such as synthesized speech, telephone tone decoding, and so forth which were not needed for test production). Recordings on the Antex board are of the same quality as on the IBM Voice Communication Option. The Antex board has a line level input which means that recordings are to be made on a cassette recorder and then transferred to the board. Even though this process is more tedious than a direct voice recording, it yields a quieter, overall better-quality recording. It is also possible to transfer pre-recorded materials (e.g., live interviews, radio shows, television sound tracks, and so forth) onto the board.

Both devices did eventually yield good results. Voice quality on both was deemed good. Ease of use, after a period of adjustment, was deemed acceptable. Ariew experimented with both boards and with transferring live recordings as well as pre-recorded materials. The pre-recorded materials were used in test items at the Superior level while live recordings (which are more understandable) were used at the lower proficiency levels.

Dunkel used the recording studios of The Pennsylvania State University to produce an audiotape of the speech segments and item cues for the conversations, questions, and so on. Professional radio announcers for WPSU, the University's radio station, were used to record the audio material onto reel-to-reel audiotape which was then transferred to cassette format. The cassette continuing the audio cues was then transferred from a dual-cassette Realistic SCT-84 Stereo Dual Cassette Deck player into the computer for digitization and storage. Various methods of transfer were investigated. Since the IBM XT 286 machine was meant to receive an 8 Ohm signal from a microphone, some difficulty was encountered with the attempt to input the audio material directly from the recorder into the digitizing board. The board does not have a volume control for received input, so

the cassette signal overpowered the input device. A 25 Ohm potentiometer and a 10 Ohm resistor were used to adjust the output from the tape recorder to the proper level expected by the IBM board. In future computerized-adaptive test development projects, investigation of speech generation systems other than the IBM XT 286 should be considered in order to determine the optimal hardware configuration for the creation of such a test. Consideration should be given to the Macintosh or the NeXT systems for continued development efforts.

Test Evaluation

Although it remained outside the scope of the investigation to produce a truly valid listening comprehension proficiency test, a number of test items were produced that, although not validated, were found to be representative of items that would have been produced under more rigorous development conditions. These prototype items (for English as well as for French) were used in informal evaluation situations. This evaluation was conducted not for the purpose of validating the items, but merely to try out the testing strategy and to insure that the program, along with its graphics and voice files, did in fact work properly.

Ariew tested the French listening proficiency test of approximately 35 items with two subjects. The program worked well and there was no problem from the standpoint of test use. The users found the test easy to take and the voice component worked flawlessly. Furthermore, the test yielded proficiency ratings that were plausible, given the users' general language proficiency.

Dunkel's evaluation efforts were preliminary at best since it took an enormous amount of time to complete the design specifications for the software to run the exam. Adopting a top-down approach to test development (i.e., designing the file structure and application logic of the program) rather than a bottom-up approach (i.e., beginning with item writing and screen displays) meant that a good deal of

time was spent in conceptualizing and designing the applications software for the test. Less time was, therefore, allotted to the running of subjects through the test. This face validation effort will continue throughout the academic semester of spring 1989 with support provided by the Department of Speech Communication in the form of a graduate assistant who will run non-native speaker subjects through the test. It should also be noted that Dunkel has applied for a grant from the International Research and Studies Program to conduct a validation study of the ESL prototype, and to extend the prototype to the critical African language Hausa.

Dissemination of Results

Both Ariew and Dunkel went to great length to disseminate the results of the project to the American and international language teaching community. Ariew read a paper on the project on the occasion of the conference on Computers in Writing and Language Instruction, held at the University of Minnesota, Duluth, Minnesota on August 1-5, 1988. In addition, Ariew read another paper at the local Educational Technology Fair held at the University of Arizona, Tucson, Arizona on October 27, 1988.

Dunkel delivered papers on the project at international conferences in East Germany, Australia, and the Netherlands. She spoke at the 14th International Congress of Linguists in East Berlin in August of 1987, at the 8th World Congress of Applied Linguists in Sydney Australia, also in August of 1987, and at the 8th International Simulation and Gaming conference held at the University of Utrecht in the Netherlands. In addition, Dunkel presented a paper about the project at Ohio State's First International Conference on Perspectives in Adult Second Language Acquisition in October, 1988. She was also invited to speak at the Department of Defense colloquium sponsored by ACTFL for DOD foreign language teachers. She has been invited to present a description of the ESL test

development effort at the First International Conference on Computer-Assisted Language Learning in Rostock, East Germany in November of 1989. Dunkel will also speak about the project at the 1989 TESOL conference that will be held in San Antonio, Texas, in March of 1989. She is chairing the Academic Session on Computer-Assisted Testing of L2 Listening and Reading Comprehension at TESOL. Dunkel was also interviewed about the project on the Dean's List, a weekly program about faculty research at Penn State, that is broadcast by WPSU radio. Finally, Dunkel is editing a book for Newbury House, a division of Harper & Row publishers, on **Research Issues in Computer-Assisted Language Learning and Testing,** scheduled for publication in the fall of 1989, in which a chapter describing the DOE project will appear. Dunkel has also authored a chapter in the Pennington and Stevens's book **Computers in Applied Linguistics: An International Perspective,** scheduled for publication by Multilingual Matters in the spring of 1990. The project has received a good deal of publicity at conferences and in publications, and dissemination of information about the project will continue into the next few years since computer-assisted assessment is a primary area of research and development for Dunkel. For Ariew, investigation in the area of computer-assisted learning is a prime interest, so discussion of the results of the project will be ensured.

Areas of Further Study

This project had concrete results: two prototypes for computer adaptive listening comprehension tests were created, one for English and one for French. The feasibility of such tests is now demonstrated.

The project also disclosed the need to address several important issues and to continue the probe to develop refined applications for L2 testing:

(1) A validated listening comprehension test has yet to be devised. It is anticipated that validating a sufficient number of items will take some time and will require support through another funded project. (Dunkel has made application to the 1988 International Research and Studies competition for support (a) to extend the generic English prototype by creating a greater quantity of items, and to conduct validation studies of the ESL item bank; and (b) to develop a computerized-adaptive test in the African language Hausa.)

(2) A similar listening comprehension test might be devised for other microcomputer delivery systems. A test using a Macintosh microcomputer would be useful and would probably be easier to implement, given the Macintosh's built-in features for storing and producing computer-generated speech. The use of laser-optical technology in the development of a listening proficiency test should be probed. The NeXT computer environment might prove more efficient and practical for future development efforts because of the hard-wired, speech-generation capability of the computer. In addition, the NeXT computer has an add-on Winchester 270 MB optical disk drive for the storage and retrieval of massive amounts of data, which would be needed for a full-blown Listening CAT in French and ESL.

(3) Listening comprehension tests for other languages should be devised, including tests for the commonly-taught languages As previously noted, a grant proposal to develop a test in Hausa has been submitted to the Department of Education's International Research and Studies program by Dunkel.

(4) Research and development should take place to "flesh out" the Generic Listening Comprehension Guidelines proposed by ACTFL. As presently constituted,

the Guidelines are very general and can not be used to guide the numerous types of listening items that would be required for a full-scale assessment across all the proficiency levels identified in the Guidelines. In addition, researchers should engage in research to understand the myriad psycholinguistic and sociolinguistic factors involved in the comprehension of aurally received messages. As noted above, Dunkel will be engaged in investigating and developing a model of the determinants of listening comprehension with Craig Chaudron and Grant Henning in connection with the collaborative research fellowship awared by the National Foreign Language Center; however, experimental and ecological research in the decoding of L2 messages should be encouraged since listening comprehension is perceived by researchers in second language acquistion today to be the very "keystone" to second language acquisition.

The Basic Research Question: Is It Feasible to Design and Implement a Listening CAT on PC Hardware?

The one-year Penn State project has clearly demonstrated the feasibility of creating a CAT of L2 listening comprehension proficiency as a possible alternative to the traditional format of the audiotape-paper-and-pencil listening test; however, during the course of conducting the Penn State project, it becomes eminently clear that a good deal of further research and development into present-day and emerging speech technology will be needed. In addition, commitments to validation, as well as development, efforts will be needed if we are to ever conceive of and tap the power of the computer to deliver a noninstitution-specific, valid, reliable test of L2 listening comprehension proficiency. Building a standardized metric of listening proficiency in the commonly-taught, as well as the less-commonly taught languages is an exceedingly labor-intensive and complex task that calls for the combined

expertise of scholars and researchers in computer science (i.e., programmers, graphics artists, hardware/software savants), educational psychology (i.e., those trained in testing and measurement), linguistics (those knowledgeable about theoretical and applied linguistics), second language acquisition and pedagogy, cross cultural communication, and even media production. Team effort, both of an inter- and intra-institutional nature, may be needed to create and implement an L2 listening proficiency CAT.

It is anticipated that the microcomputers of the 1990s will have speech-generating processors built into their architecture, much as the NeXT computer of today has. The inclusion of speech processors in the basic system architecture of computers will obviate one of the major problems encountered by the project investigators: the need to build and patch elements of disparate systems together to create, in essence, a hybrid system that accepts, stores, and generates voice output. Computer systems containing built-in voice generation capabilities (e.g., the NeXT) should eliminate the need to create these hybrid systems that can pose problems of noncompatibility or noninterface between the various software packages, device drivers, and the hardware add-ons. The IBM system used for the PSU-DOE project was a hybridized, at times a Frankenstein, system, containing numerous add-on boards (e.g., the Voice Communications board, and the EGA graphics board), various vendor software packages [e.g., PC Paint and DBase III Plus], and non-IBM hard disks [e.g., the 80 MB Seagate hard disk]). While the test does, indeed, run on such an conglomerated system, it is felt that a more fully integrated speech-delivery system, such as that provided by the NeXT system, stands to pose fewer potential problems of noncompatibility and noninterface, and should eliminate possible system errors and crashes. The Next system, or the Macintosh systems should, above all, simplify the test development effort. A

system that comes equipped with speech input/output capabilities should provide a more powerful, reliable, and, above all, a more friendly environment for CAT test development and delivery. To date, the IBM PC systems do not incorporate speech input/output as an integral, hard-wired component. In all likelihood, this situation will change in the future, but for those beginning to develop an audio-enhanced, PC-based test, it would seem more advantageous to build the test on a system that has a built-in speech-digitizing processor, and that has advanced graphics capabilities also hard-wired into the system.

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The Pennsylvania State University
Department of Speech Communication
Sparks Building
University Park
Pennsylvania, 16802

System Design of a PC-based L2 Listening Comprehension Test

Dr. Patricia Dunkel (Co-Principal Investigator, DOE Grant)
Gary C. Morrison (Software Designer and Programmer)

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CONTENTS

Preface ii

Section 1: System Overview 1

System Functions 1
System Requirements 1
System Constraints 4
System History 6

Section 2: System Architecture 7

Section 3: Hardware Configuration 8

Application Development Configuration 8
Application Execution Configuration 9

Section 4: System Software Architecture 10

Physical Allocation Of Software Components 11
Logical Allocation Of Software Components 11
Test Mode Software Components 11
DESIGN Mode Software Components 13
Software Inventory 15
Additional Notes 15

Section 5: System Users 16

Section 6: File Structure 17

VOICE Files 17
Details On Usage 17
Naming Format 18
Internal Format 18
File Size 18
Programs That Use VOICE Files 18
GRAPHICS Files 19
Details On Usage 19
Naming Format 19
Internal Format 20

File Size 20
Programs That Use GRAPHICS Files 20
DBASE Files 21
Details On Usage 21
Naming Format 21
Internal Format 21
File Size 22
Programs That Use DBASE Files 22

Section 7: Database Structure 23

Data Fields In The GLOBAL Database 23
Data Fields In The DIRECT Database 25
Data Fields In The LEVEL1, ... , LEVEL10 Databases 26
Data Fields In The RESULTS Database 27

Section 8: Application Logic For TEST Mode 29

Purpose Of TEST Mode 29
TEST Mode Program Execution 29
TEST.BAT Purpose 30
TEST.BAT Source Language 30
TEST.BAT Inputs-Outputs-Control 30
TESTBGIN.PGM Purpose 30
TESTBGIN.PGM Source Language 31
TESTBGIN.PGM Inputs-Outputs-Control 31
DOTEST.PGM Purpose 32
Program Logic For DOTEST.PGM 32
DOTEST.PGM Source Language 33
DOTEST.PGM Inputs-Outputs-Control 33
TESTEND.PGM Purpose 34
TESTEND.PGM Source Language 34
TESTEND.PGM Inputs-Outputs-Control 35

Section 9: Application Logic For DESIGN Mode 36

First Version Of DESIGN Mode 36
Purpose Of DESIGN Mode 36
MAINMENU.BAT - The Backbone Of DESIGN Mode 37
CRETVOIC.BAS Purpose 38
CRETVOIC.BAS Source Language 38
CRETVOIC.BAS Inputs-Outputs-Control 38

Section 10: Hard Disk Configuration 41

Directory Creation Guidelines 42
Directory Maintenance Guidelines 42

Section 11: Testing the System 43

Section 12: Additional Enhancements 44

Appendix A: Data Entry Forms 45

Test Variables Data Entry Form 45
Directions Data Entry Form 47
VOICE File Data Entry Form 48
GRAPHICS File Data Entry Form 52
Test Question Data Entry Form 54

Appendix B: Glossary Of Terms 55

Appendix C: ESL Screens (Selected Sample) 57

Appendix D: ESL Items Tape Script 58

TABLES

1. System Architecture 7
2. System Software Architecture 10
3. Flow Diagram Of TEST Mode 12
4. Flow Diagram Of DESIGN Mode 14
5. Programs That Use VOICE Files 19
5. Programs That Use GRAPHICS Files 20
7. Programs That Use DBASE Files 22
8. GLOBAL Database Format 24
9. DIRECT Database Format 25
10. LEVELxx Database Format 26
11. RESULTS Database Format 28
12. Program Response Chart For TESTBGIN.PGM 32

13. Program Response Chart For DOTEST.PGM 34
14. Program Response Chart For TESTEND.PGM 35
15. Program Response Chart For MAINMENU.BAT 38
14. Program Response Chart For CRETVOIC.BAS 40

PREFACE

This document contains the high level system design and the software detail design of a PC-based listening comprehension test. This application is intended to be employed in testing foreign students' English listening comprehension skills. The most notable aspect of this design is the emphasis on simplicity of implementation, ease of use and ease of maintenance. However, even with the goal of designing a system that is easy to use and maintain, the implementation of this design will require a significant amount of resources and should be considered before undertaking such a project.

Aside from implementation and ease of use factors, this design also is 'language independent.' Simply stated, this design will produce a system that can provide a listening comprehension test in any language. Also, it can be implemented on a non-PC computer.

In summary, this document provides a vastly improved software design over the initial design included in the Interim Report to the Department of Education, submitted in February, 1988, and is the result of approximately 1000 programmer hours of design, coding, documentation and maintenance. It is intended to provide a foundation for future researchers who are considering computer-based solutions to the problem of developing a listening comprehension test.

Section 1

SYSTEM OVERVIEW

1.1 System Functions

The major function of this application is to test the listening comprehension abilities of persons whose native language is other than English. The application entails playing portions of pre-recorded speech (i.e., words, phrases, statements, questions, and/or dialogs) while also displaying simple graphics on a computer screen which correspond with the speech being played. The individual taking the test listens to the utterances and uses the information heard to answer questions, the correct answer to which is contained in the multiple choices displayed on the computer screen. Answers are entered into the system by pressing a key on a computer, generally key #1, #2, #3, or #4. As the individual answers the test questions, the computer monitors the respondent's success in answering the questions correctly. If the number of questions answered incorrectly exceeds a predetermined number, then the individual is tested with questions that are considered to be easier. Conversely, if the number of questions answered correctly exceeds another predetermined number, then the individual is tested with questions that are considered to be more difficult. If the individual has not answered questions in such a way as to satisfy either of these conditions, then the test is terminated. Furthermore, since the test questions have been prearranged into levels of listening proficiency, based on the Listening Guidelines set by American Council on the Teaching of Foreign Languages, the level at which the individual completes a test is considered to be the level of English listening proficiency for that person. The level of proficiency of each individual who takes the test will be recorded after the test has terminated, together with additional information pertaining to the number of questions attempted, the number of questions correctly answered, and relevant additional demographic information (e.g., the number of years the testtaker has studied English, and so forth).

Additional functions of the system include the ability to enter and modify test questions, and audio cues. Since each test question is composed of speech and pictures that are playable/displayable by a computer, functions had to be provided by the system to record and play speech and record and display pictures in the form of computer graphics similar to those most people associate with computer video games.

1.2 System Requirements

To provide a more concrete definition of the system, the system requirements for this application are provided in the list given below:

1. The system will run on an IBM PC/XT equipped with a VOICE digitization board, an Extended Graphics Adapter board and an Extended Color Display, a mouse, a microphone, a headset, 640 kilobyte (KB) RAM, an 80 megabyte (MB) hard disk, a 1 megabyte ram disk and a parallel printer.

2. The portions of speech to be used for the listening comprehension test will be recorded on a tape cassette; therefore, the system must be able to read the speech from a tape player into the system hard disk for future access.

3. The test must support 10 testing levels, named 'Level 1,' 'Level 2,' 'Level 10.'

4. Each testing level must support three sections of question types. The sections will be named the 'Dialog Section,' 'Question Section,' and 'Statement Section.' A section may have from 1 to 99 test questions.

5. During test execution the test will start at a predetermined testing level that is modifiable from the user interface level (does not require a programmer or re-programming).

6. During test execution when a testing level is begun, all questions of all three sections of the current level being tested will be executed before leaving that level or terminating the test.

7. When a level of the test is performed the 'Question Section' will be played first, the 'Statement Section' will be played second, and the 'Dialog Section' will be played last.

8. The sequence of test questions within a section will be determined by a test question number assigned to each test question, within a section. For example, if the 'Statement Section' of test level two has ten questions, then they will be numbered 1 through 10. When the 'Statement Section' of test level two is performed, the order of test question execution is always, 1 first, 2 second, and so on to the test question 10.

9. A 'test question' is comprised of two computer screens and two portions of speech. The screens are named: 'the question screen', and 'the answer screen.' The portions of speech are named 'the dialog portion' and 'the question portion.' A 'test question' is comprised of the following sequence of actions:

   Action 1 - 'the question screen' is displayed on the terminal.

   Action 2 - 'the dialog portion' of speech is played on the computer speaker or headset.

   Action 3 - 'the question portion' of speech is played on the computer speaker or headset.

   Action 4 - 'the answer screen' is displayed on the terminal

   Action 5 - the test taker's response is recorded. If the test taker's response is to replay the test question and if the test question has been marked in the system as a "replayable" test question, then the test question is restarted. A test question can only be replayed once. Also, if the test question is not answered after a predetermined period of time the test taker will be prompted by a message at the bottom of the computer display. If the test taker does not answer after an additional period of time then the answer is recorded as incorrect.

10. After all test questions at a testing level have been executed, the test will evaluate the answers given by the test taker with the correct answers to determine if a more difficult level of test questions should be executed, if an easier level of test questions should be executed, or if the test should be terminated.

11. The criteria to be used in selecting test levels will be be given using two integer values. One value will be the minimum number of CORRECT answers that must be answered to move UP to the next testing level. The other value is the maximum number of CORRECT answers that can be given to move down to an easier testing level.

12. No evaluation of additional testing levels will be performed at the end of testing level one or ten.

13. After the last testing level has been executed the test taker's 'level of proficiency' will be determined as follows:

    If the number of correct answers given is below the minimum number allowed for that level and if the current testing level is level one, then the test taker's level of competence' is 'level 0.'

    If the number of correct answers given is below the minimum number allowed for that level and if the current testing level is not level one, then the test taker's level of competence' is the current testing level minus 1.

    If the number of correct answers given exceeds the maximum number allowed for that level and if the current testing level is level ten, then the test taker's 'level of competence' is 'level 11.'

    If the number of correct answers given falls in the range of 'equal to or greater than' the minimum number and 'equal to or less than' the maximum number allowed for that level, then the test taker's 'level of competence' is the last test level executed.

14. The amount of time allowed to answer a question at each testing level must be modifiable at the user level for designated levels (e.g., novice-low to low-intermediate levels).

15. A 'Quit' key must be provided so that the test can be terminated at any time without damaging the system files.

16. The ability to replay a particular test question must be allowed during the execution of the test at designated levels e.g., novice-low to low-intermediate levels).

17. The creation, modification and deletion of the test questions must be provided by the system without the support of a computer programmer.

18. The sound quality of the speech played by the system must have a sound quality at least as good as the sound quality of an AM radio broadcast.

19. Test question screens must be constructed using the PC Paint product, will have 4 colors, resolution of 620 X 200 pixels, and be saved in BSAVE format.

20. The ability to provide directions before any test question must be provided and be definable at the user level.

21. A directions sequence should include from one to three graphics screens and provide one portion of speech to be played after each graphics screen is displayed.

22. A directions sequence can be assigned to be given before any question in the test.

23. The system must provide a method (e.g., with a relational data base such as d-Base III Plus) to track the system components that store the portions of speech and the graphics screens. This will be used to assist in maintaining the test questions over time.

24. Demographic information on each test taker, as well as the final test level attained, and the number of questions asked and answered correctly, must be recorded in a database.

25. A user interface must be provided to assist in the maintenance of the system by graduate students or assistants who have limited computer background. It can also be assumed that the graduate students are able to refer to vendor manuals for assistance in using vendor products that are employed in the system (i.e., help manuals for DBASE III Plus, PC Paint).

26. A tape backup system should be provided to store application code and software programs and test taker's input.

27. A user's guide for the system should be provided.

1.3 System Constraints

The full implementation of this design is not trivial. The greatest constraints that will inhibit the successful implementation of this system are the following:

The amount of time needed by trained personnel to write and test the programs, record and manage the files containing digitized speech, create and manage graphics screens, create and update the system file database, create the test items, pilot run the test, and maintain the system harddisk.

The programming skills needed to create the assembly code to write the graphics driver that, in turn, writes 16 color screens to the EGA memory are considerable.

The skills needed to create high quality graphics screens are considerable.

The overall and requisite knowledge of the system hardware devices is considerable and can not be underestimated.

Although the time requirements are substantial to implement the system, the number of files needed to implement the system are also substantial. For example, a test that includes 10 testing levels, 3 sections per testing level, 10 questions per section, and 6 direction sequences of three screens per testing level could require the following number of files:

Test Question Files

10 levels * (3 section/level) * (10 question/section) = 300 questions

300 questions * (2 graphics files/question) = 600 graphics files

300 questions * (2 voice files/question) = 600 voice files

600 graphics files + 600 voice files = 1200 Test Question files

Direction Sequence Files

10 levels * (6 direction sequences/level) = 60 direction sequences

60 direction sequences * (3 graphics files/sequence) = 120 graphics files

60 direction sequences * (3 voice files/sequence) = 120 voice files

120 graph. files + 120 voice files = 240 Direction Sequences files

Total File Count

1200 Test Quest. files + 240 Direction files = 1440 files

File Size In Megabytes Of Disk Storage

720 graphics files * (16KB/file) = 12 Megabytes

720 voice files * (approx. .5 min.s/file) * .155MB/min. = 56 Megabytes

12 Megabytes + 56 Megabytes = 68 Megabytes of disk storage required for VOICE and GRAPHICS files only

As the previous calculations demonstrate, the system requirements, in terms of number of files and amount of disk storage, are significant. Note that the size of additional system files is not included. These can require another 15 to 20 Megabytes. The task of maintaining and tracking the files on the system will also require a significant amount of time and should be considered in project planning. Serious consideration should be given to using the 25-MHz NeXT computer system which has an optional 670 megabyte magneto-optical drive, with an average seek time of 18 milliseconds.

An unexpected system constraint discovered during initial prototype development was the complexity of EGA formatted graphics screens. To circumvent this problem, BSAVE formatted graphics screens which are displayable from DBASE III Plus and BASIC were used.

Another system constraint stems from the problem of transferring the portions of speech from a tape recorder to the IBM VOICE board installed in the PC. The major problem is that the analog signal from a tape recorder is not the same frequency that is created by a microphone (which is the format expected by the IBM board). The output from the tape recorded can be adjusted using a potentiometer. Our project used a 25 Ohm potentiometer and a 10 Ohm resistor to adjust the output from the tape recorder to the proper level expected by the IBM board. This equipment may vary depending on the tape recorder used.

1.4 System History

The original design of the system was implemented using BASIC. However, the system as implemented was difficult to maintain and to use. A number of additional user requirements were also discovered during this initial period of development (e.g., the need to provide a directions sequence before any test question, and to track system files). These additional requirements have been included in this new design.

The decision to use DBASE III Plus to implement the software portion of the system was made because DBASE III Plus provides good programmer productivity features and a user interface that allows easy creation and modification of the system database that is used to track all the system components. The first implementation of this system uses bit-mapped graphics that are in BSAVE format. Additional work in the future may include the ability to display 16 color EGA formatted screens.

Section 2

SYSTEM ARCHITECTURE

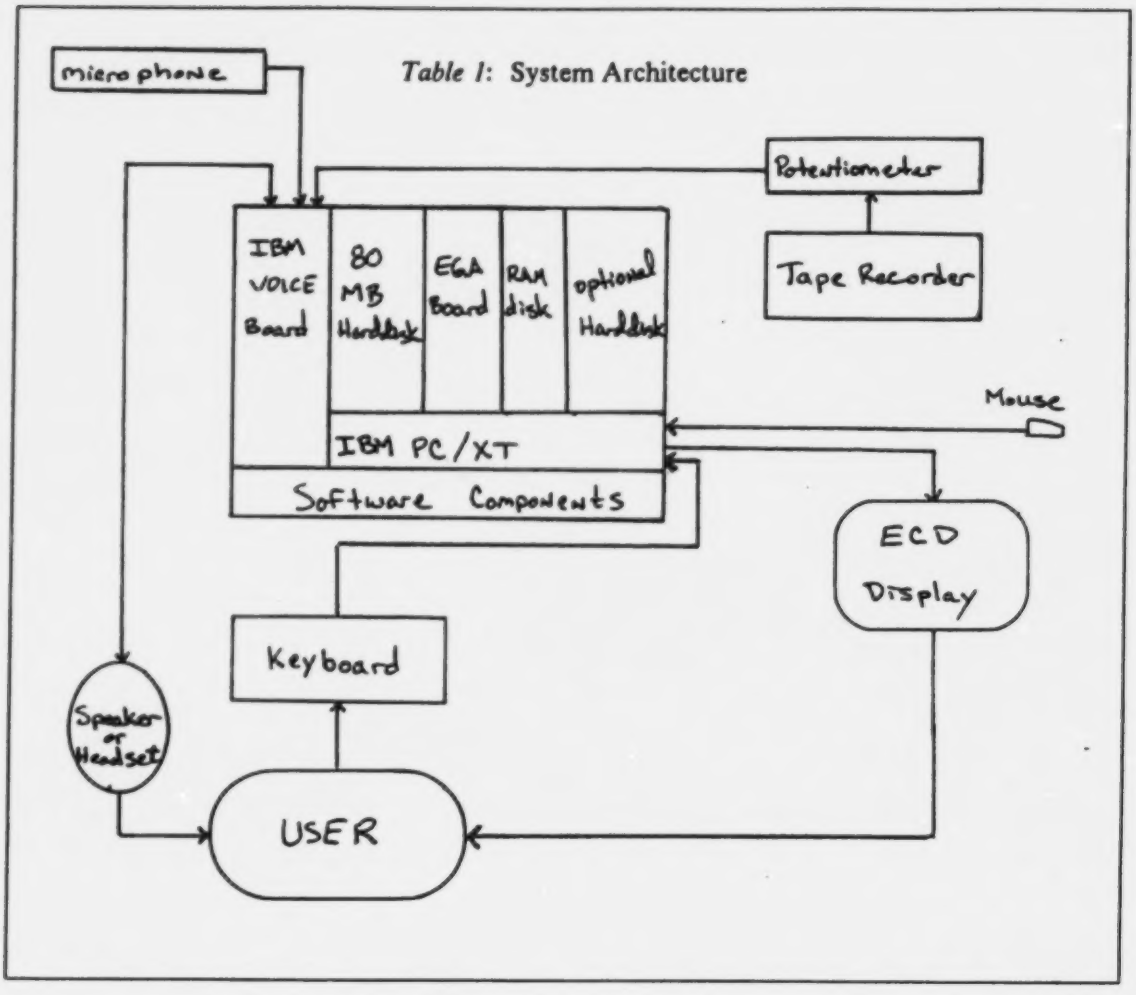


Table 1: System Architecture

Table 1, above shows in graphical form, the system architecture which contains various hardware components and the software component. The next section provides in greater detail the actual hardware devices needed to implement this project and the remainder of the system design will provide the details of the software component, shown above as one block.

Section 3

HARDWARE CONFIGURATION

There are two modes of operation for this system. There is an 'application development' mode and an 'application execution' mode. The 'application development' mode of operation comprises the activities of constructing and maintaining the software and hardware components of the system. The 'application execution' mode involves the activity of testing an individual for English listening comprehension skills. The components that will comprise each mode of operation are given in the following sub-sections:

3.1 Application Development Configuration

The hardware components needed during application development include the following hardware devices:

- CPU - IBM PC XT/286 (contains an 80286 microprocessor)
- Memory- 640 KB RAM
- Operating System - DOS, Version 3.3
- Disk Capacity
  - 80 MB Seagate hard disk partitioned into C, D, and E drives.
  - 1.2 MB High-density 5 1\4" Floppy Drive (A drive)
  - 360 KB 5 1\4" Floppy Drive (B drive)
  - 2 MB Ramdisk - an Everex board (MicroSoft/LOTUS/Intel standard) containing 2 MB of extended memory is configured as an F disk
- Graphics interface - IBM extended graphics display and extended graphics (EGA) board
- Sound Interface - IBM Voice Communications Subsystem and Operating System; includes a board, device driver and demo programs
- Mouse - Mouse Systems optical mouse; includes a mouse, a board, a device driver and a screen compiler. (The mouse is connected to communications port 2.)
- Tape backup - Maynard Tape backup system; includes a board and menu driven software

- o Miscellaneous Hardware - dot matrix parallel printer, speaker, microphone, headset, and tape player/recorder

3.2 Application Execution Configuration

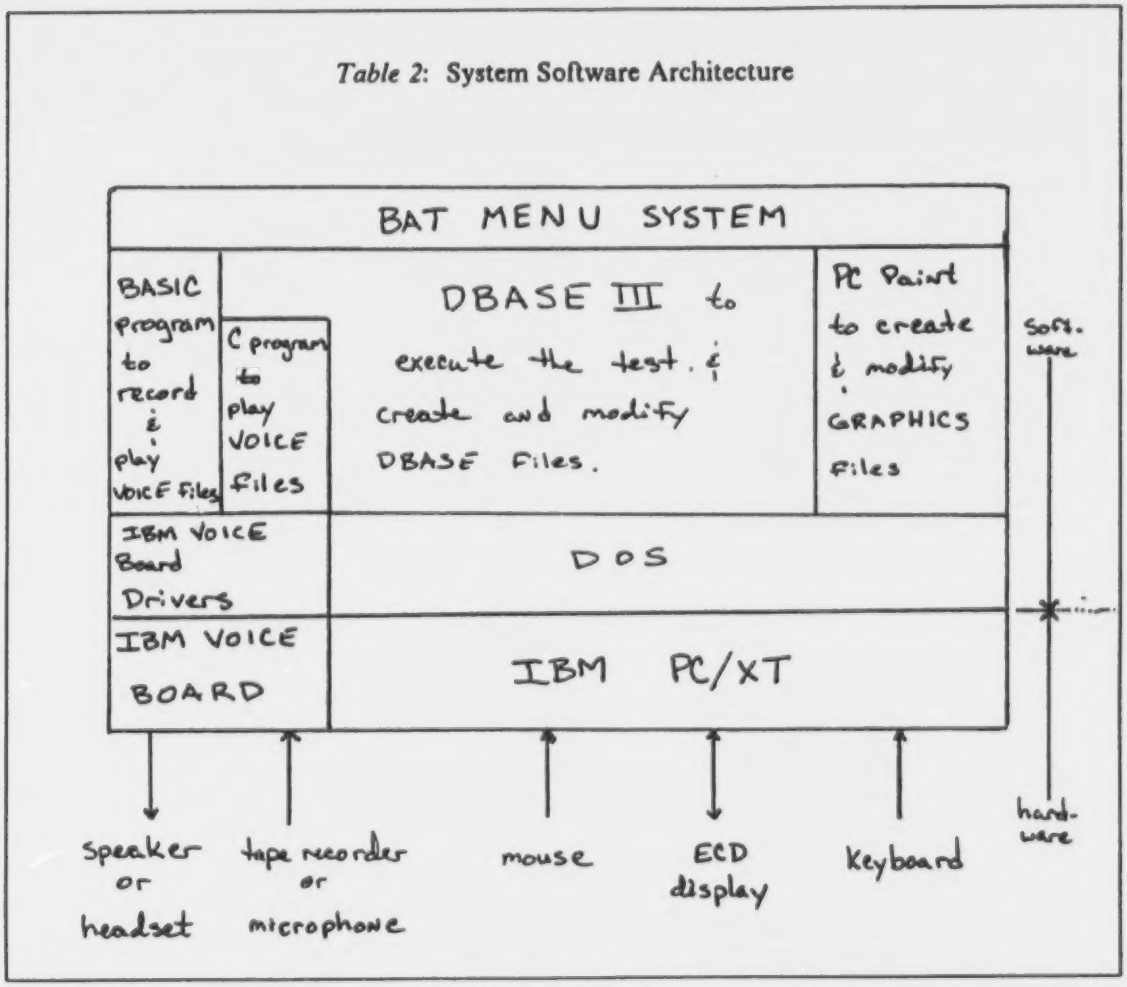
The hardware components needed during application execution will include all the devices mentioned in the development configuration less the tape recorder, potentiometer, mouse, dot matrix printer, microphone and the tape backup system.

Section 4

SYSTEM SOFTWARE ARCHITECTURE

The architecture of the software component of the system is provided in Table 2, given below.

Table 2: System Software Architecture



4.1 Physical Allocation Of Software Components

The architecture allocates the software into a number of blocks. Each block and the function performed by it are given below:

1. BAT Menu System Block - provides a high level menu interface for the user to select the task desired, such as creating a graphics screen, entering a test question, entering a portion of speech or executing the test.

2. BASIC Block - allows the recording and the playing of portions of speech.

3. C Block - provides the playing of portions of speech during the execution of the test.

4. DBASE III Plus Block - executes the listening comprehension test; allows tracking of system components; allows construction and modification of the test questions and the test structure.

5. PC Paint Block - provides an environment to create and modify graphics screens.

6. DOS Block - is the operating system for the PC XT.

7. VOICE Driver Block - provides application interface to the VOICE board.

4.2 Logical Allocation Of Software Components

Overall, the software architecture consists of two logical modes of operation, a TEST Mode and a DESIGN Mode. The TEST Mode executes the listening comprehension test and the DESIGN Mode is used to construct the components of the system that store the portions of speech, the graphics screens, information about each test question and the status of each component stored in the system.

4.2.1 Test Mode Software Components

The TEST Mode component of the software consists of 5 programs. The name and purpose of each program are given below:

- TEST.BAT - a DOS BAT program that loads DBASE III Plus and starts the first DBASE program, TESTDRVR.PGM

- TESTDRVR.PGM - a DBASE III Plus program that provides the control for programs running in DBASE III Plus. TESTDRVR.PGM calls TESTBGIN.PGM, DOTEST.PGM and TESTEND.PGM

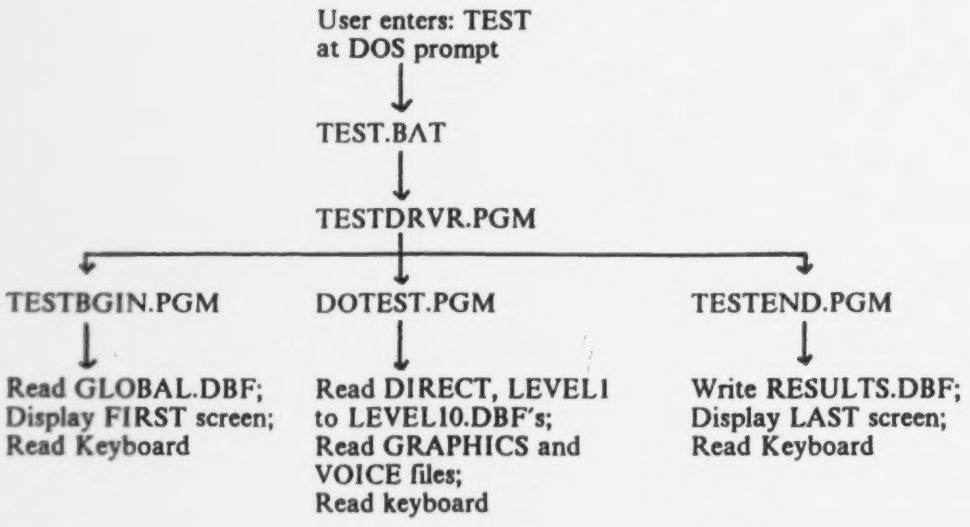
- TESTBGIN.PGM - a DBASE III Plus program that collects demographic information from the test taker

- DOTEST.PGM - a DBASE III Plus program that executes the test

- TESTEND.PGM - a DBASE III Plus program that writes the test results to a DBASE III Plus database

A flow diagram of TEST Mode is given in Table 3, shown below.

Table 3: Flow Diagram Of TEST Mode



Additional details about the TEST mode of operation are given in another section.

4.2.2 DESIGN Mode Software Components

The DESIGN Mode component of the software sub-system consists of 6 programs, the DBASE III Plus, PC Paint and Maynard Tape Backup environments. The name and purpose of each is given below:

Programs

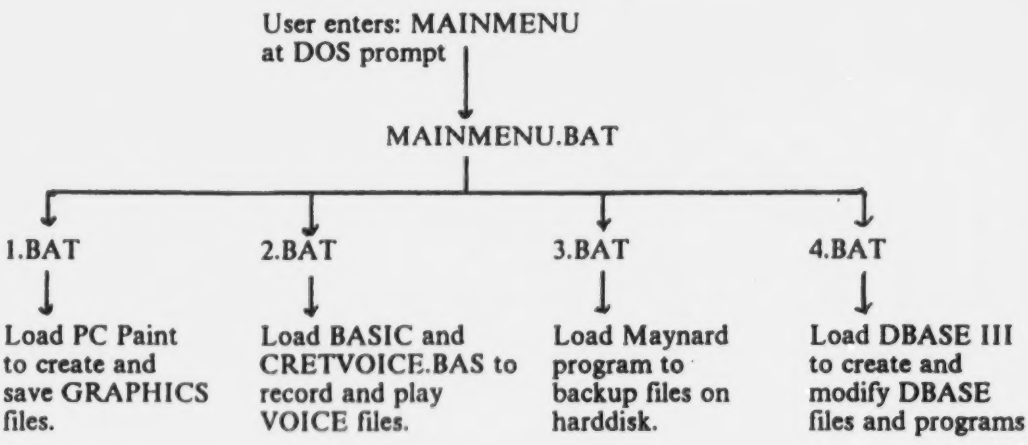
- MAINMENU.BAT - a selection menu for the DESIGN Mode tasks
- 1.BAT - loads and executes PC Paint
- 2.BAT - loads and executes a BASIC program to record and play the portions of speech
- 3.BAT - loads and executes Maynard Tape back up program
- 4.BAT - loads and executes DBASE III Plus
- CRETVOIC.BAS - provides for the recording and playing of portions of speech using the IBM voice board

Environments Provided By Vendor Products

- DBASE III Plus environment - allows for the creation and modification of DBASE III Plus databases; also provides a run time environment for DBASE III Plus programs
- PC Paint environment - provides for the creation and modification of bit-mapped graphics screens
- Maynard Tape Backup environment - provides for the copying and restoring of the system harddisk to a tape cassette

The flow diagram for DESIGN Mode is given in Table 4 shown below.

Table 4: Flow Diagram Of DESIGN Mode


User enters: MAINMENU
at DOS prompt
MAINMENU.BAT
1.BAT
2.BAT
3.BAT
4.BAT
Load PC Paint to create and save GRAPHICS files.
Load BASIC and CRETVOICE.BAS to record and play VOICE files.
Load Maynard program to backup files on harddisk.
Load DBASE III to create and modify DBASE files and programs

Additional details about the DESIGN mode of operation are given in another section.

4.2.3 Software Inventory

The following software products were purchased to assist with the development of the software components of the system:

PC Paint - creates bit-mapped graphics screens

PC Paint Fonts and Pictures - professionally created PC Paint fonts and bit-mapped pictures

DBASE III Plus Plus - provides a database editing environment, program development environment and a runtime environment

DBASE C Library - library of C programs that are callable from DBASE III Plus and perform such functions as regression analysis

DBASE Graphics Library - library of C programs that are callable from DBASE III Plus and perform such graphics functions as display bar charts

Storyboard - integrates sequence of speech and graphics into a presentation 'show'

MicroSoft C Compiler - provides a development environment to write C programs

MicroSoft Assembler - provides assembly of 8088/80286 assembly programs.

Maynard Tape Backup - provides tape backup of the system harddisk

DOS 3.3 - operating system of the PC/XT

PC Tools - assist system maintenance

Each of the above mentioned software products are stored on the system hard disk in a separate directory. The system harddisk structure is given in a section later in the design.

4.2.4 Additional Notes

The design of the graphics screens or the text of the various test questions are included in the Appendix of this design document. The contents of these screens (i.e., the stems of the test items and the answer choices) will be defined on data entry forms and entered into the system using DESIGN Mode. Refer to the appendix to see a copy of the sample screens and the data entry forms used to capture the information needed to perform the test.

The following sections will cover in greater detail the system users, the file structures, the database formats, and the application logic that will be used to define the software component.

Section 5

SYSTEM USERS

Several classes of users have been identified as persons who will construct or use the system described in this document. The user classes are:

- **Test Taker** - The test taker is the individual who takes the test. 'Taking the test' precisely is the activity which includes listening to the English utterances and conversations produced by the computer, listening to questions about the utterances and conversations, reading the possible answers displayed on the computer monitor, and pressing a number key which indicates to the computer the test taker's response to the current question. The test taker also has to provide demographic data at the beginning of the test, such as her or his years of experience with English, age, occupation, etc.

- **Test Supervisor** - The test supervisor may or may not be present when the test taker is taking the test. If the test supervisor is present, he or she may assist in starting the application by turning the computer on and typing in the command 'TEST.'

- **Test Designer** - The test designer is the individual who prepares each question for the different sections and levels, and the related requirements and specifies the contents of each screen, the speech heard during the test, the correct answers, the order in which questions are asked, the design of the algorithm used to adjust the testing level during the test, the initial test level used, how many attempts allowed to listen to a question, how long the test taker has to answer the question, and how many questions are asked at each testing level.

- **Graphics Artist** - The graphics artist will use the PC Paint product to create, 4 color, BSAVE formatted screens that are 620 by 200 pixels in resolution. Each screen has been created using the PC Paint tool. The graphics artist will save the file to the correct directory on the PC hard disk.

- **Data Entry** - A data entry person may also be needed to assist in the transfer of the test questions from paper to DBASE III Plus and the transfer of the recorded speech from a tape recorder to the hard disk of the computer using the DESIGN Mode of operation.

- **Programmer** - A computer programmer is required to code the various BAT, BASIC and DBASE programs indicated in this design and will probably be required to perform maintenance on the application software after implementation. The programmer will also be responsible for system testing which should be used to verify the system operates as defined in this design document. Any changes made in the software that deviate from the design document should be recorded in the design document.

The test taker and the test supervisor will only use the TEST Mode function of the system, while the test designer, graphics artist and data entry persons will use the DESIGN Mode functions. The programmer will use both modes of operation to perform system testing.

Section 6

FILE STRUCTURE

The files used in this system have been named and divided into three major filetypes which are called:

- o VOICE files
- o GRAPHICS files
- o DBASE files

VOICE files contain digitized speech that the IBM Voice Communication Board can read and play back. GRAPHICS files contain the information needed to create high resolution screens using the PC Paint product. DBASE files are those that can be created and modified with the DBASE III Plus full screen editor and can read and write from within a DBASE III Plus program.

The following three sections contain details of the use, the naming format, the file size, the internal format, and the program functions that operate on the various file types.

6.1 VOICE Files

6.1.1 Details On Usage

VOICE files contain the digitized representation of the speech phrases used by the Voice Communications board. VOICE files are created by selecting the 'Create VOICE Files' option on the DESIGN Mode Main Menu. The system then displays a VOICE file function menu which provides options to record a VOICE file, play a VOICE file, see the VOICE file directory or return to the DESIGN Mode Main Menu. VOICE files can then be created by selecting the 'Record' option, providing a VOICE file name and then speaking into a microphone attached to the Voice Communications board. Similarly, voice files can be created by attaching a tape recorder (see section 1.3) to the microphone-input slot. The Voice board stops recording after two seconds of silence are encountered during recording. To play a VOICE file, the user provides the VOICE filename, and then the system plays the VOICE file to a speaker or headset attached to the Voice board. The VOICE file function menu also provides an option to display the VOICE files currently on the system. When the designer-user user wants to return to the DESIGN Mode Main Menu, she or he can select the 'Quit' option.

After the VOICE files are created and stored on the system harddisk, the VOICE filenames are then entered into the proper system database. Then during test execution, the TEST Mode programs will read the VOICE filenames needed to perform each test question from the system databases and play the files using the IBM VOICE board as needed.

6.1.2 Naming Format

The format for naming a VOICE file is the following:

```
Lnnsqqta.VOC
```

where:

nn - is the level number of the test question, such as an integer 1 to 10.

s - is the section type, such as 'S' for 'STATEMENT' section, 'Q' for 'QUESTION' section and 'D' for 'DIALOG' section

qq - is the question number of the test question within the current test section, such as an integer from 1 to 99

t - is the VOICE file type and can be either, 'Q' for question, 'S' statement or 'D' for dialog. (To be clear, the 'Statement' VOICE file contains the initial speech played which the taker must listen to. The 'Question' speech file contains a portion of speech that is a question about the 'Statement' speech played. The 'D' designator would indicate that the VOICE file contains speech that is played when directions are given to the test taker.)

a - is optional, and is used when the VOICE file type is 'D.' (Since directions can use up to three VOICE files, the files will have 'a' part of the filename equal to, 1, 2, or 3.)

6.1.3 Internal Format

Knowledge of the internal format of VOICE files is not necessary at the application level. Further, it is not provided in the IBM documentation.

6.1.4 File Size

It has been observed that the average amount of disk space consumed for one minute of speech is 155 KB, plus or minus 40KB. This indicates that about 12 megabytes of disk space will be needed to store about an hour's worth of VOICE files. Since the size of a VOICE is linearly dependent on the length of speech that has been recorded into it, the size of VOICE files can accurately be predicted using as a guideline 155 KB plus or minus 40 KB.

6.1.5 Programs That Use VOICE Files

Table 5 given below provides a brief analysis of programs that use VOICE files.

Table 5: Programs That Use VOICE Files

Mode	Program Name	File Operation
DESIGN	CRETVOIC.BAS	Write (record) Read (play)
TEST	DOTEST.PGM	Read (play)

6.2 GRAPHICS Files

6.2.1 Details On Usage

The GRAPHICS files contain the information necessary to 'paint' the screens seen by the test taker during the test. These screens will support comprehension of utterances (the VOICE files), as deemed appropriate, and may provide answers to questions to which the test taker has listened. The screens are created by selecting the 'Create GRAPHICS file' option on the DESIGN Mode Main Menu. The system then loads the PC Paint software product where the GRAPHICS file can be created. When completed, the GRAPHICS file can contain up to 4 colors, have a resolution of 620 by 200 and be saved in BSAVE format.

After the GRAPHICS files are created and stored on the system hard disk, the GRAPHICS filenames are then entered into the proper system database. Then during test execution the TEST Mode programs will read the GRAPHICS filenames needed to perform each test question from the system databases and display the GRAPHICS files on the Extended Color Display as required.

6.2.2 Naming Format

The format for naming a GRAPHICS file is the following:

```
Lnnsqqta.PIC
```

where:

nn - is the level number of the test question, such as an integer 1 to 10

s - is the section type, such as 'S' for 'STATEMENT' section, 'Q' for 'QUESTION' section and 'D' for 'DIALOG' section

qq - is the question number of the test question within the current test section, such as an integer from 1 to 99

t - is the GRAPHICS file type and can be either, 'Q' for question, 'S' for statement or 'D' for dialog. (To be clearer, the 'Statement' GRAPHICS file contains the screen to be displayed while the initial sample of speech is played to which the test taker must listen. The 'Question'

GRAPHICS file contains the screen to be displayed while the portion of speech that is a question about the 'Statement speech portion' is played. The 'D' designator indicates that the GRAPHICS file contains the screen that will be displayed while the directions speech is being played.)

a - is optional, and is used when the GRAPHICS file type is 'D.' (Since directions can use up to three GRAPHICS files, the files will have a part of the filename equal to, 1, 2, or 3.)

6.2.3 Internal Format

The internal format of the GRAPHICS files is not required when the files are in BSAVE format. However, if it is deemed desirable to display the screens with a resolution of 620 by 350 pixels in 16 colors, then it will be necessary to understand the internal structure of these screens in order to read the screens using 80286 assembly language. This information can be obtained by writing the developers of the PC Paint product, MSC Technologies, Sunnyvale, California.

The current implementation of this system uses BSAVE formatted screens which have 4 colors and 620 x 200 pixels; however, use of more sophisticated graphics and a greater number of colors would be desirable.

6.2.4 File Size

GRAPHICS files that are in BSAVE format require 16 KB of disk storage. A GRAPHICS file in PC Paint's proprietary format requires from about 3 KB to 11 KB of disk storage.

6.2.5 Programs That Use GRAPHICS Files

Table 6 given below provides a brief analysis of programs that use GRAPHICS files.

Table 5: Programs That Use GRAPHICS Files

Mode	Program Name	File Operation
DESIGN	PC Paint	Write (create) Read (display)
TEST	DOTEST.PGM	Read (display)

6.3 DBASE Files

6.3.1 Details On Usage

DBASE files are created by using DBASE III Plus and are used to store the name and status of every VOICE and GRAPHICS file used in the system. The data entry person and the test designer will create and maintain the DBASE files using DBASE III Plus in 'edit mode.' Although this will require the data entry person and the test designer to use DBASE III Plus, it greatly improves the organization of the system and reduces the programming effort significantly as compared with a 'home-grown' file organization system.

There are four main types of databases. One database stores all the information that is relevant to all questions in the test and is named the 'GLOBAL' database. Another database contains the filenames of the VOICE and GRAPHICS files that are needed to give directions during the test. This is called the 'DIRECT' database. The third database stores the test taker's score and the demographic information asked of the test taker at the beginning of the test. This is called the 'RESULTS' database. The last group of databases contains the information about each test question (e.g., the VOICE and GRAPHICS files needed to perform the test question, whether the question can be replayed and what the correct answer to the question is). These are called 'LEVEL' databases. The exact DOS filename of each of these databases is given in the next section.

6.3.2 Naming Format

There are four types of DBASE files (also referred to as a database). They are named:

GLOBAL.DBF

DIRECT.DBF

RESULTS.DBF

LEVEL1.DBF, LEVEL2.DBF, ... , LEVEL10.DBF

All the DBASE files will be created using the DBASE III Plus editing commands. When storing the DBASE files do not append the '.DBF' extension. DBASE III Plus will automatically append this extension when storing the DBASE files that are created in DBASE III Plus. Additional files may also be created automatically by DBASE III Plus, such as index files. These files have an '.IDX' extension. These files should be considered a part of each database and should be moved or copied along with any '.DBF' files, in the event they need to be moved or copied.

6.3.3 Internal Format

Knowledge of the internal format of the DBASE files is not required at the application level of programming, however, the fields that will be defined as a part of the database will be covered in the 'Database Structure' section.

6.3.4 File Size

The size of DBASE files is linearly dependent on how many test questions are used in the test and how many individuals have taken the test. The approximate size of the DBASE files for a 300 question test is approximately 3 MB.

6.3.5 Programs That Use DBASE Files

Table 7 given below provides a brief analysis of programs that use DBASE files.

Table 7: Programs That Use DBASE Files

Mode	Program Name	File Operation	Database
DESIGN	DBASE III Plus	Write Read & Write Read	All All All
TEST	TESTDRVR.PGM	Read	GLOBAL
TEST	DOTEST.PGM	Read	DIRECT LEVELx
TEST Mode	TESTEND.PGM	Write	RESULTS

Section 7

DATABASE STRUCTURE

The software portion of the system needs to access a large amount of information in order to operate properly. This information ranges from the filenames of VOICE and GRAPHICS files to the correct answer for each test question and the amount of time the test taker has to answer a question. The design and implementation of the system software has been standardized and simplified by using DBASE III Plus to store all the system related information. The information that is stored in the DBASE III Plus databases can logically be divided into databases that store information needed to perform the test, and databases that store information that results from executing the test. The test results will be stored in the RESULTS.DBF file, or more easily referred to as the 'RESULTS' database. (The RESULTS.DBF file and the 'RESULTS' database are the same software object.) The remaining databases all store information related to performing the test. The GLOBAL.DBF database contains information pertaining to the overall execution of the test (e.g., the number of testing levels and the criteria for selecting various testing levels during test execution. The DIRECT.DBF database contains information concerning the presentation of directions to the test taker during execution of the test. The remaining databases all contain information relevant to the execution of test questions at one level in the test. For example, the DBASE file named 'LEVEL2.DBF' contains all the information related to test questions at 'level 2' in the test. In summary, there are four types of DBASE files and they are named:

RESULTS.DBF

GLOBAL.DBF

DIRECT.DBF

LEVEL1.DBF, LEVEL2.DBF, ... , LEVEL10.DBF

(The '.DBF' is the DOS extension that DBASE III Plus automatically adds to the database name, which is the portion of the name that precedes the '.' in the name.) The data fields contained in each of the system databases are given in the following sub-sections.

7.1 Data Fields In The GLOBAL Database

The structure of the GLOBAL Database is given in Table 8 which designates the field name, field type and field width of each row in the database. After the GLOBAL database is created using the DBASE III Plus editor, the information provided on the 'Test Variables Data Entry Form' (see appendix) will be entered into the GLOBAL database by the Data Entry individual or some other person assigned to this task.

The description of each field is given below:

Table 8: GLOBAL Database Format

Field No.	Field Name	Data type	Width
1	Lowest	Integer	2
2	Highest	Integer	2
3	Initial	Integer	2
4	MoveUp	Integer	2
5	MoveDown	Integer	2
6	Time	Integer	2
7	GPath	Character	30
8	VPath	Character	30

NOTE: DBASE III Plus restricts field names to 8 characters.

Lowest - lowest level number for the test. (The level number is appended to the word 'Level' to give the appropriate database name that contains the file information for that level, i. e., Level1, ..., Level10.)

Highest - the highest level number that can be given on the test

Initial - the starting level to be used for the test

MoveUp - the threshold number that is used to indicate that the next highest testing level should be used to test the test taker. (For example, if the test taker answers 12 questions correctly in a test level that has a 'MoveUp' variable set to an integer less than 12, then the test would continue by asking questions from the next higher level in the test.)

MoveDown - the threshold number that is used to indicate that the next lowest testing level should be used to test the test taker. (For example, if the test taker answers 4 questions correctly in a test level that has a 'MoveDown' variable set to an integer that is greater than 4, then the test would continue by asking questions from the next lowest level in the test.)

Time - the number of seconds the test taker has to answer a question

GPath - the DOS path to the GRAPHICS directory (i.e., E:\GRAPHICS)

VPath - the DOS path to the VOICE directory (i.e., E:\VOICE)

The GLOBAL database file would be created by the test designer using the DBASE III Plus editor. (The exact instructions on creating and entering data into a DBASE III Plus database are given in the DBASE III Plus manual and are not covered in this document.) After the GLOBAL database is created the Data Entry person can edit the database to make any changes desired by the test designer.

7.2 Data Fields In The DIRECT Database

The structure of the DIRECT Database is given in Table 9 which designates the field name, field type and field width of each row in the database. After the DIRECT database is created using the DBASE III Plus editor, the information provided on the 'Directions Data Entry Form' (see appendix) will be entered into the DIRECT database Table 9

Table 9: DIRECT Database Format

Field No.	Field Name	Data type	Width
1	LevelNo	Integer	2
2	Section	Char	1
3	QuestNo	Integer	2
4	Voice1	Char	8
5	StatV1	Char	1
6	Voice2	Char	8
7	StatV2	Char	1
8	Voice3	Char	8
9	StatV3	Char	1
10	Graph1	Char	8
11	StatG1	Char	1
12	Graph2	Char	8
13	StatG2	Char	1
14	Graph3	Char	8
15	StatG3	Char	1

NOTE: DBASE III Plus restricts field names to 8 characters.

The description of each field is given below:

LevelNo - the level number where the directions are given (The value should be 1 to 10)

Section - each level is segregated into three types of test questions which are named 'QUESTION,' 'STATEMENT,' and 'DIALOG' sections. The Section field will contain either 'Q,' 'S,' or 'D' to indicate in which section of that level that particular question is located.

QuestNo - the number of the question within the current testing level that the directions sequence will precede.

Voice1, Voice2, Voice3 - the name of the VOICE file that contains the speech to be played as a part of providing the directions. (The VOICE files are played in ascending sequence and will be played after the corresponding GRAPHICS file is displayed on the screen.)

StatV1, StatV2, StatV3 - the status of each of the VOICE files given in Voice1, Voice2 and Voice3. (The value of status field can be 'V' to indicate the file is valid or can be 'P' to indicate that there is a problem with the file.

Graph1, Graph2, Graph3 - the name of the GRAPHICS file that contains the graphics screen to be displayed as a part of providing the directions

StatG1, StatG2, StatG3 - the status of each of the GRAPHICS files given in Graph1, Graph2 and Graph3 (The value of status field can be 'V' to indicate the file is valid or can be 'P' to indicate that there is a problem with the file.)

7.3 Data Fields In The LEVEL1, ... , LEVEL10 Databases

The structure of the LEVEL1 to LEVEL10 Databases is given in Table 10 which designates the field name, field type and field width of each row in the databases. After the LEVELx databases are created using the DBASE III Plus editor, the information provided on the 'Directions Data Entry Form' (see appendix) will be entered into the DIRECT database.

The structure of the LEVELx Databases is given in Table 10 containing the field name, field type and field width, followed by a short description of the purpose of each field.

Table 10: LEVELxx Database Format

Field No.	Field Name	Data type	Width
1	Section	Char	1
2	QuestNo	Integer	2
3	VoiceD	Char	8
4	StatVD	Char	1
5	VoiceQ	Char	8
6	StatusVQ	Char	1
7	Direct	Boolean	1
8	GraphQ	Char	8
9	StatGQ	Char	1
10	GraphA	Char	8
11	StatGA	Char	1
12	Replay	Boolean	1

NOTE: DBASE III Plus restricts field names to 8 characters.

The description of each field is given below:

Section - Each level is segregated into three types of test questions which are named, 'QUESTION', 'STATEMENT', and 'DIALOG' sections. The Section field will contain either,'Q,' 'S,' or 'D' to indicate in which section of that level the particular question is located.

QuestNo - the number of that question within a section of a testing level (Questions will be asked in ascending sequence.)

VoiceD - the name of the VOICE file that contains the statement or dialog portion of the test question.

StatVD - the status of the VoiceD file (The value of status field can be 'V' to indicate the file is valid or can be 'P' to indicate that there is a problem with the file

VoiceQ - the name of the VOICE file that contains the question portion of the test question

StatusVQ - the status of the VoiceQ file The value of status field can be 'V' to indicate the file is valid or can be 'P' to indicate that there is a problem with the file

Direction - indicates whether directions are supposed to be given prior to executing this question (The proper values for this field are 'Y' or 'N')

GraphQ - the name of the QUESTION file that contains the screen that is to be displayed during the question portion of the test question

StatGQ - the status of the 'GraphQ' file (The value of status field can be 'V' to indicate the file is valid or can be 'P' to indicate that there is a problem with the file

GraphA - is the name of the QUESTION file that contains the screen that is to be displayed during the answer portion of the test question.

StatGA - the status of the 'GraphA' file (The value of status field can be 'V' to indicate the file is valid or can be 'P' to indicate that there is a problem with the file

Replay - indicates whether the test taker can replay the test question (Valid values for this field are 'T' or 'F'.

The LEVEL1, ... , LEVEL10 databases would be created by the test designer and updated by the data entry person as directed by the test designer using the DBASE III Plus editor.

7.4 Data Fields In The RESULTS Database

The structure of the RESULTS Database is given in Table 11, containing the field name, field type and field width, followed by a short description of the purpose of each field.

The description of each field is given below:

TestNo - a unique number assigned to a particular test taker

EndLevel - the level of the test the test taker successfully completed

QuestNo - total number of questions asked

Correct - total number of questions answered correctly

EYears - number of years test taker has used/studied English

Age - age of test taker in years and months

Table 11: RESULTS Database Format

Field No.	Field Name	Data type	Width
1	TestNo	Integer	8
2	EndLevel	Integer	2
3	QuestNo	Integer	3
4	Correct	Integer	3
5	EYears	Integer	2
6	Age	Integer	3
7	Sex	Char	1

NOTE: DBASE III Plus restricts field names to 8 characters.

Sex - sex of test taker; 'F' for Female; 'M' for Male. Additional fields containing relevant demographic data (e.g., country of origin, native language, etc.) can be created as deemed desirable and necessary.

Section 8

APPLICATION LOGIC FOR TEST MODE

8.1 Purpose Of TEST Mode

This section contains the high level design of the software component of the TEST Mode of operation. The purpose of the TEST Mode of operation is to test the test taker's listening comprehension proficiency in English. Since the projected pool of test takers will have diverse levels of skill at this activity, the test will tailor the questions asked of the test taker by selecting them from a particular level of test questions. For this reason, the test questions have been segregated into testing levels and further segregated into three sections of test questions per level (i.e., comprehending statements, selecting appropriate responses to questions, and comprehending dialogs). After the test taker has completed a testing level, his or her current progress will be evaluated against a predetermined algorithm to determine if the test should end, proceed to a more difficult test level or proceed to a less difficult test level.

8.2 TEST Mode Program Execution

The TEST Mode of operation is initiated by typing 'TEST' at the DOS prompt when the current directory is the root directory of the C drive of the system. After the word 'TEST' has been typed, and the ENTER key pressed, the TEST mode of operation will begin by displaying the FIRST screen which prompts the test taker to answer various questions about herself or himself, (e.g., "How many years have you studied English?"). The test taker completes the fields and presses the ENTER key which results in the display of the directions as well as spoken directions played on the speaker or headset. After the directions have been given, the test taker responds to a prompt by pressing any key to start the test.

The test begins with a short monolog or dialog which is followed by another speaker who asks a question about the monologue or dialogue just presented. After the speech portions have terminated, the list of answers the test taker has to select from will be displayed on the monitor. The application then waits for the test taker to respond by pressing a key such as the, 1-key, 2-key, 3-key or 4-key, which corresponds to answers given on the screen. If the test taker does not answer after a predetermined period of time, a prompt will be displayed stating the test taker must answer within ten seconds. If the test taker does not answer within ten seconds, the answer is recorded as incorrect, and the next question is displayed. In addition, at the bottom of every answer/question screen is a key that can be pressed to exit the test. If the test taker presses it, then a prompt is given which allows the person to confirm that he or she wants to terminate the test. If the test taker makes this confirmation, then the TEST Mode of operation is terminated, and the test taker is returned to the DOS prompt. Otherwise, if the test taker indicates at the confirmation prompt that she or he wants to continue the test, the test resumes with the current question. After the test taker answers each question, the response is recorded as either correct or incorrect. When the test has been completed, the test results are written to the appropriate DBASE file, and a final screen is displayed stating that the test has been completed. If the test taker

presses any key at this point, control returns to the DOS prompt, and the TEST Mode of operation will terminate.

The TEST Mode portion of the application consists of the following programs:

- TEST.BAT - starts the listening comprehension test
- TESTDRVR.PGM - calls the various programs that perform the TEST Mode of operation
- TESTBGIN.PGM - collects the demographic information and gives directions
- DOTEST.PGM - gives each question & collects test taker's response.
- TESTEND.PGM - writes test results to the GLOBAL database and informs the test taker that the test has been completed

The specifications for each of the TEST Mode programs is given in the sub-sections that follow.

8.2.1 TEST.BAT Purpose

TEST.BAT starts the TEST Mode of operation when the test taker types 'TEST' at the DOS prompt, while in the C:\ directory, and presses the ENTER key. TEST.BAT will then change the current directory to the C:\TEST directory and invokes DBASE III Plus and loads the TESTDRVR.PGM as the first program.

8.2.2 TEST.BAT Source Language

TEST.BAT is written in DOS BAT command

8.2.3 TEST.BAT Inputs-Outputs-Control

The inputs, outputs and control for the TEST.BAT are:

Called by - test taker

Returns to - DOS

Screens displayed - none

8.2.4 TESTBGIN.PGM Purpose

TESTBGIN.PGM first displays a screen that will collect demographics information from the test taker. After the test taker has completed the demographics screen and presses F2, a sequence of screens giving directions for taking the test will be displayed. These directions will demonstrate to the test taker how the test questions will be organized and how they must answer the questions. After the directions have been given, the test taker initiates the test by pressing F2 to begin the test. Control then returns to the TESTDRVR.PGM. (The directions will be both viewed and heard.)

8.2.5 TESTBGIN.PGM Source Language

TESTBGIN.PGM is written in DBASE III Plus.

8.2.6 TESTBGIN.PGM Inputs-Outputs-Control

The inputs, outputs and control for the TESTBEGIN.PGM are:

Called by - TESTDRVR.PGM

Returns to - TESTDRVR.PGM

Screens displayed - FIRST, and directions screens (not shown here)

Screen definition for FIRST screen:

```
1 FIRST
2
3                      -- LISTENING COMPREHENSION TEST --
4
5
6    Please fill in the fields below then press F2 to begin the test.
7
8
9
0    Number of years you have used English : __
1
2
3    ..... more fields to be added as deemed desirable
4
5
6
7
8
9
0
1
2    Press F1 to Quit  OR  Press F2 to begin test.
3
4                    <error messages displayed here>
```

Table 12: Program Response Chart For TESTBGIN.PGM

Key Pressed	Action Performed
F2	Store demographic information into global variable pool and return to DOTEST.PGM
Any key other than F1 or F2	Display screen with an error message and all data maintained
F1	Clear screen, leave DBASE III Plus and return to DOS

8.2.7 DOTEST.PGM Purpose

DOTEST.PGM begins by reading the GLOBAL database file that stores general information about the listening comprehension test.

After DOTEST.PGM has read the information from the GLOBAL database, the database for the initial testing level would be read, and the test question of the QUESTION section would be executed. After all the test questions in the QUESTION section have been given, then all questions in the STATEMENT section would be given, followed by all questions from the DIALOG section.

If a test question has a set of directions that should be given prior to its execution, the DOTEST.PGM program must read the DIRECT database to obtain the VOICE and GRAPHICS file names corresponding to the directions sequence that is to be given.

8.2.8 Program Logic For DOTEST.PGM

The logical steps of execution for the DOTEST.PGM are as follows:

1. Read the contents of the LISTEN database.
2. Set the first test level equal to the INITIAL level given in the LISTEN database.
3. For each question in the QUESTION Section do the following steps:
    a. Read the file names of the VOICE and GRAPHICS files.
    b. If HAVEDIRECTIONS is equal to 'Y' then go play the directions sequence.
    c. Write the GraphicsQuest file to the screen.
    d. Play the VoiceQuest file to the headset or speaker.
    e. Write the GraphicsAnswer file to the screen.

f. Play the VoiceAnswer file to the headset or speaker.

g. Read the test taker's response and perform action given in table below.

h. If the test taker's response is correct, increment the total number correct by one and the number correct at this level by one.

4. For each question in the STATEMENT Section, do steps "a" though "h," as indicated above.

5. For each question in the DIALOG Section do steps "a" though "h," as provided above.

6. Set the LEVEL_CHANGED_FLAG to 'NOT_CHANGED.'

7. If the total number of answers correct is greater then the MoveUpAfter variable, set the current level to next higher level and set the LEVEL_CHANGED_FLAG to 'CHANGED.'

8. If the total number of answers correct is less than the MoveDownAfter variable, set the current level to next lower level and set the LEVEL_CHANGED_FLAG to 'CHANGED.'

9. If the current level is 0, then set the final level achieved to one and set the LEVEL_CHANGED_FLAG to 'NOT_CHANGED.'

10. If the current level is 11, then set the final level achieved to ten and set the LEVEL_CHANGED_FLAG to 'NOT_CHANGED.'

11. If the LEVEL_CHANGED_FLAG equals 'CHANGED,' then return to Step 2 to begin testing at the next level.

12. Call the TESTEND.PGM and pass all demographic information and the test results to TESTEND.PGM as well.

8.2.9 DOTEST.PGM Source Language

DOTEST.PGM is written in DBASE III Plus.

8.2.10 DOTEST.PGM Inputs-Outputs-Control

The inputs, outputs and control for the DOTEST.PGM are:

Called by - TESTDRVR.PGM

Returns to - TESTDRVR.PGM

Screens displayed - graphics screens defined in the GRAPHICS Files Data Entry Forms (see appendix)

Inputs - Each test question may have up to 4 possible answers to select from so DOTEST.PGM must be able to record the pressing of the 1, 2, 3 or 4 keys, the 'replay' key or the 'quit' key. DOTEST.PGM should handle program keyboard input in the following manner, shown in Table 13 given below.

Table 13: Program Response Chart For DOTEST.PGM

Key Pressed	Action Performed
1 key, 2 key 3 key or 4 key	If answered within time allowed for this level, then the answer is recorded and the next text question sequence is given.
Test taker has taken too long to answer question	An error message is given stating the test taker must answer the question in the allotted time for this level; if no response is given within the proper time, then the test taker's response is rerecorded as incorrect, and the next test question sequence is started.
F1	A prompt is given, asking if the test taker really wants to quit. If they answer 'YES,' then return to DOS; otherwise, continue the test by repeating the current question.
F2	Replay the last question if the Replay variable equals 'YES'; otherwise record the answer as incorrect and continue with the next question.
Any key other than F1, F2, or the 1, 2, 3, or 4 keys	Record answer as incorrect and begin the next question sequence.

8.2.11 TESTEND.PGM Purpose

TESTEND.PGM stores the levels of the test that were given during the test, the number of answers correctly answered at each level, and the test taker's final level of achievement on the test into the RESULTS database. The last task performed by the TESTEND.PGM is to inform the test taker that he or she has completed the test and can inform the test supervisor that he or she is done. Pressing any key while the LAST screen is being displayed will return the system to TESTDRVR.PGM.

8.2.12 TESTEND.PGM Source Language

TESTEND.PGM is written in DBASE III Plus.

8.2.13 TESTEND.PGM Inputs-Outputs-Control

The inputs, outputs and control for the TESTEND.PGM are:

Called by - TESTDRVR.PGM

Returns to - TESTDRVR.PGM

Screens displayed - LAST.

Screen definition for LAST screen:

```
1 LAST
2
3                    -- LISTENING COMPREHENSION TEST --
4
5
6
7
8
9                                Good job!
0
1
2      You have completed the test.   You can take off the headset,
3
4      and tell the test supervisor you have finished the test.
5
6
7
8                             Have a nice day!
9
0
1
2                    <error messages displayed here>
3
4    Press any key to return to DOS
```

Table 14: Program Response Chart For TESTEND.PGM

Key Pressed	Action Performed
any key	Save test results in the RESULTS database and return to TESTDRVR.PGM

Section 9

APPLICATION LOGIC FOR DESIGN MODE

9.1 First Version Of DESIGN Mode

The first version of DESIGN Mode contained a hierarchy of panels and called several programs to build the file structure that is now being maintained in DBASE III Plus database files. This new design has several advantages over the previous design. They are as follows:

There is less application code to write and maintain; therefore, the application is much easier to implement and more dependable.

Tests are constructed using the DBASE III Plus editor to edit the 'spreadsheets' of filenames and attributes used for each testing level.

Each level of the test is easier to comprehend because of the database display provided by the DBASE III Plus editor.

DBASE III Plus also provides a database of the status of each VOICE and GRAPHICS file in the system.

Since most of the DESIGN Mode uses DBASE III Plus and PC Paint, very little work is necessary to construct a system help manual since PC Paint and DBASE III Plus provide help manuals on the usage of those products.

9.2 Purpose Of DESIGN Mode

The purpose of the DESIGN Mode of operation is to assist the test designer, graphics artist, or data entry person in creating, modifying and deleting tests and portions of tests. These functions can be performed by using either DBASE III Plus, PC Paint, or by executing an interactive BASIC program to record and play VOICE files. The task of constructing large numbers of these files can be quite complicated and tedious. For example, for a test that contains ten testing levels with three sections at each level and ten test questions per section, it is necessary to design and document 300 test questions on paper first, and then enter them into the computer via DESIGN Mode. Furthermore, since every test question contains two GRAPHICS files and two VOICE files, what might seem a modest application contains over 1200 files to organize and maintain. When the added complication of providing directions at any point in the test is considered, a few hundred more VOICE and GRAPHICS files are needed, in addition to the need to have another database to store the file names used in each directions sequence. For this reason alone, DESIGN Mode has been designed to be very easy to understand and use.

9.3 MAINMENU.BAT - The Backbone Of DESIGN Mode

The basic structure of the DESIGN Mode is quite simple. After the system is turned on, a DOS BAT file named, MAINMENU.BAT, is executed and provides a screen-like prompt that provides easy access to invoking the correct software product or application program that is used to create or modify a VOICE, GRAPHICS or DBASE file. The test designer, graphics artist, or data entry person can then enter 1, 2, 3, etc., to perform the task indicated on the screen. For each task on the the MAINMENU screen, there is a BAT named, 1.BAT, 2.BAT, etc., that invokes the correct product or program and then executes the MAINMENU.BAT file after the user completes the various tasks selected. This provides a menu interface for DESIGN Mode that provides all the assistance necessary to perform the tasks required. Once the user is 'inside' PC Paint or DBASE III Plus, he or she can refer to the corresponding user's guide for help on performing a given task. The BASIC program that provides the ability to record and play VOICE files is so easy to use that no help guide is needed. The menu that is displayed may be changed as deemed necessary or desirable during application development; therefore, the specification for the DESIGN Mode given here should be considered a guideline, if modifications are made.

The MAINMENU.BAT screen should look like the following:

```
1 ************************************************************************
2
3              Penn State Listening Comprehension Research
4
5 ************************************************************************
6   Enter 1, 2, 3, or 4 and press ENTER to select a task below.
7
8
9         1 - PC Paint to create graphics screens
0         2 - Record or Play a VOICE file
1         3 - Back up the system hard disk
3         4 - Start DBASE III Plus
```

For a complete listing of MAINMENU.BAT, 1.BAT, 2.BAT, 3.BAT, and 4.BAT, see the appropriate appendix.

Table 15: Program Response Chart For MAINMENU.BAT

Key Pressed	Action Performed
1 key	Execute the 1.BAT program that loads and executes PC Paint. After the user leaves PC PAINT, MAINMENU.BAT is executed.
2 key	Execute the 2.BAT program that loads and executes CRETVOIC.BAS in BASIC. After the user leaves BASIC, MAINMENU.BAT is executed.
3 key	Execute the 3.BAT program that loads and executes the MAYNARD tape backup system. After the user exits the MAYNARD tape program, MAINMENU.BAT is executed.
4 key	Execute the 4.BAT program that loads and executes DBASE III Plus. After the user leaves DBASE III Plus, MAINMENU.BAT is executed.

9.3.1 CRETVOIC.BAS Purpose

CRETVOIC.BAS is used to record and play VOICE files by calling the IBM Voice 'board'. CRETVOIC.BAS also allows the display of the current contents of the various directories containing VOICE files. CRETVOIC.BAS operates by displaying the VOICE screen given below and waits until the user enters an 'R', 'P', 'S' or 'Q'. If 'R' or 'P' is read, then the CRETVOIC displays the next prompt to enter the VOICE file name.

9.3.2 CRETVOIC.BAS Source Language

CRETVOIC.BAS is written in IBM BASIC.

9.3.3 CRETVOIC.BAS Inputs-Outputs-Control

The inputs, outputs and control for the CRETVOIC.BAS are:

Called by - 2.BAT

Returns to - 2.BAT

Screens displayed - VOICE

Screen definition for VOICE screen:

```
VOICE

          -- LISTENING COMPREHENSION TEST - DESIGN Mode --

     Enter R, P, S, or Q to perform the desired task.

             Record a VOICE File

             Play a VOICE file

             See a VOICE file directory

             Quit and return to the DESIGN Mode Main Menu


     Enter Selection ====> _


     Enter Filename or Level Number ====> _

                  <error messages displayed here>
```

Table 14: Program Response Chart For CRETVOIC.BAS

Key Pressed	Action Performed
R key	Ask user for a filename; after filename is given, begin recording after any key is pressed. After two seconds of silence, quit recording and return the screen to the original display.
P key	Ask user for a filename; after filename is given, begin playing the file after any key is pressed. When finished playing the file, return the screen to the original display.
S key	Ask the user which testing level to show; after entering a testing level number, show the directory with the /W option. After displaying the directory, wait until any key is pressed to return to the original display.
Q key	Clear the screen, leave BASIC, return to MAINMENU.BAT.

Section 10

HARD DISK CONFIGURATION

The following list is the name and purpose of the directories that the system will use to organize the software elements of the system:

- C:\DBASE - contains the DBASE system files needed to execute DBASE III Plus properly and any programs and/or directories needed to develop the DBASE programs needed to implement this application.

- C:\DESIGN - contains the program files needed to execute the DESIGN Mode of the application.

- C:\DOS - contains the files necessary for the DOS operating system to operate properly.

- C:\MASM - contains the MicroSoft Assembler system files needed to operate the MicroSoft 80286 assembler properly and any programs and/or directories needed to develop the assembler programs needed to implement this application.

- C:\MAYNARD - contains the system files needed to operate the Maynard tape backup program properly.

- C:\MOUSE - contains the system files needed to operate the MicroSoft mouse and the PCPAINT directory which contains the system files needed to operate PC Paint.

- C:\MSC - contains the system files needed to operate the MicroSoft C Compiler properly and any programs and/or directories needed to develop the C programs needed to implement this application.

- C:\TEST - contains program files necessary for the execution of the TEST mode of operation.

- D:\ - will be used to store additional applications software such as WordStar and can be used to store additional VOICE and GRAPHICS files.

- E:\VOICE - contains the directories, VOICE1, ..., VOICE2, ..., VOICE10. The VOICE1, ... VOICE10 directories contain the VOICE files for each testing level.

- E:\GRAPHICS - contains the directories, GRAPH1, ..., GRAPH2, ..., GRAPH10. The GRAPH1, ... GRAPH10, directories contain the GRAPHICS files for each testing level.

- F:\ - pertinent system COM, EXE and BAT files should be copied to this drive. Also, 'F:\;' should be placed at the beginning of the DOS system PATH variable. (This will allow fast access to files that are used often.)

10.1 Directory Creation Guidelines

Additional directories can be added as needed but the following guidelines should be used:

1. No files in the D:\ and E:\ directories.
2. Only the files in the C:\ directory should be COMMAND.COM, IBMBIOS.COM and AUTOEXEC.BAT.
3. Choose directory names that are meaningful.
4. Only place files in a directory that have some common characteristic.
5. Limit the number of files per directory below 60, if possible.
6. Limit directory path lengths to 3 deep if possible.
7. Maintain a hard copy of the directory structure for easy reference.

10.2 Directory Maintenance Guidelines

The hard disk should be backed up as often as seems reasonable depending on the amount of system usage. The hard disk is backed up using the Maynard software that is provided as an option on the DESIGN Main menu. Every 3 to 6 months, the hard disk should be re-formatted to improve file access time. This can also help in extending the life of the harddisk. Also, from time to time, the files on the harddisk should be reviewed and obsolete files that may have accumulated on the disk should be erased.

NOTE: Since hard disks fail eventually, causing complete loss of data, the harddisk should be backed up anytime some irreplaceable work has been written to it. Since disk failure is a strong possibility, the hard disk shall never be considered a primary storage device. If the tape drive device is not available, then important work should be copied to a floppy using the XCOPY command.

Section 11

TESTING THE SYSTEM

After the programmer has completed implementing and unit testing (testing the individual program modules), system testing will be performed. The main purpose of this activity is to discover bugs in the code and/or design. This will be achieved by placing probes in the TESTBGIN.PGM, TESTDRVR.PGM, DOTEST.PGM and TESTEND.PGM programs that will print out intermediate results of test execution. The information that will be printed will be the following:

All demographics information

Current testing level, section and question number

The test taker's response that was recorded for the current question

The total number of correct answers recorded at each section

The testing level that was determined to be the test taker's level of proficiency with English listening comprehension

After a test-run is performed, the printed output will be compared with the information stored in the DBASE III Plus files.

Since the amount of effort needed to test every test question with a correct answer and an incorrect answer would require exhorbitant amounts of time, the definition of a sufficiently tested system will be at that point in time when the system has been executed 20 or more times without a program fault being discovered. (A fault is a deviation from the system design.)

At last, the system will be considered stable after a year of operational use and system maintenance.

Section 12

ADDITIONAL ENHANCEMENTS

Additional system enhancements can include the following:

Adding VGA graphics

Adding EGA 16 color graphics on a 620 by 350 pixel screen

Modifying the IBM VOICE driver to quit during recording or playing a VOICE file when a designated key is pressed

Improving system sound quality

Adding an optical disk

Adding a larger hard disk

Adding more memory

Moving to a 32-bit architecture CPU such as the 80386 (i.e., PS/2)

Adding 80287 floating point hardware

Adding function to scan hardcopy into the system and in a format that is modifiable by PC Paint

Appendix A

DATA ENTRY FORMS

The test designer will initially document the test questions by recording the portions of speech and the screens seen for each question on data entry forms. The following pages include copies of the forms used/to be used in our project. Furthermore, the contents of the DBASE files will be recorded on spread sheets, similar to the sheets containing columns and rows used by accountants. The forms are designed so a data entry person can enter the information from the forms into the application files from within the DESIGN Mode portion of the application.

A.1 Test Variables Data Entry Form

Test Variables Data Entry Form

DIRECTIONS: Perform the following steps:

1. Fill in the lowest testing level number.
2. Fill in the highest testing level number.
3. Fill in the starting testing level.
4. Fill in the maximum number of correct answers that will be the cutoff for moving down to the next level.
5. Fill in the minimum number of correct answers that will be the cutoff for moving up to the next level.
6. Fill in the number of seconds allowed to answer a question.

To enter this data into the proper database: Perform the following steps:

1. Enter DESIGN Mode and select the option to enter DBASE III Plus.
2. Create or modify the GLOBAL database using the DBASE III Plus editor. See the DBASE III Plus manual for help in using DBASE III Plus if necessary.

Lowest Testing Level : _____

Highest Testing Level : _____

Starting Testing Level : _____

Max. number correct to move down : _____

Max. number correct to move up : _____

Time in seconds to answer : _____

A.2 Directions Data Entry Form

Test Variables Data Entry Form

Directions: Perform the following steps:

1. Fill in the level number, section type and question number this set of directions will precede.

2. Fill in the number of directions screens to be used.

3. Fill in the VOICE and GRAPHICS filenames to be used for this set of directions.

4. Complete a VOICE and GRAPHICS data entry form for the VOICE and GRAPHICS files for this set of directions and attach them to this data entry form.

To enter this data into the proper database: Perform the following steps:

1. Enter DESIGN Mode and select the option to enter DBASE III Plus.

2. Create or modify the DIRECT database using the DBASE III Plus editor. See the DBASE III Plus manual for help in using DBASE III Plus if necessary.

TEST Level number : _____

SECTION Type : _____
(Q for Q/Answer, S for Statement
or D for Dialog)

Section Question Number : _____

Number of screens : _____

GRAPHICS Files

File name of screen1 : L_____.PIC

File name of screen2 : L_____.PIC

File name of screen3 : L_____.PIC

VOICE Files

File name of first file : L_____.VOC

File name of second file : L_____.VOC

File name of third file : L_____.VOC

A.3 VOICE File Data Entry Form

VOICE FILES Data Entry Form

Directions: Perform the following steps:

1. Fill in the test level number in the space below
2. Fill in the section Type in the space below
3. Fill in the number of the question within the current Test Section
4. Fill in the filename in which this VOICE file will be stored
5. Fill in the script that will be recorded into the 'Dialog' part of the test question
6. Fill in the script that will be recorded into the 'Question' part of the test question

To enter this data into the proper database: Perform the following steps:

1. Enter DESIGN Mode and select the option to create and change VOICE files.
2. In the Voice File panel, enter 'R' to record the 'Speech' part of the question
3. Enter the filename for the voice file using the voice file format indicated in the Voice File Specification part of the design.
4. Turn on the tape recorder and press the ENTER key on the computer to begin recording the speech.
5. Turn the tape recorder off when the speech portion has been completely recorded.
6. After the screen is updated, enter 'R' to record the 'Question' part of the question
7. Enter the filename for the voice file using the voice file format indicated in the Voice File Specification part of the design.
8. Turn on the tape recorder and press the ENTER key on the computer to begin recording the speech.
9. Turn the tape recorder off when the speech portion has been completely recorded.
10. After the screen is updated, enter 'Q' to return the quit and return to the DESIGN Mode main menu.

TEST Level number : _____

SECTION Type : _____
(Q for Q/Answer, S for Statement
or D for Dialog)

Section Question Number : _____

Speech portion stored in file : L_____.VOC

Speech portion contains the following:

Speech portion (continued)

The Question portion contains the following:

Question portion stored in file : L_____.VOC

A.4 GRAPHICS File Data Entry Form

GRAPHICS File Data Entry Form

Directions: Perform the following steps:

1. Fill in the test level number in the space below.
2. Fill in the section Type in the space below.
3. Fill in the number of the question within the current Test Section.
4. Fill in the filename in which this VOICE file will be stored.
5. Fill in the script that will be recorded into the voice files.
6. Select the PC Paint option on the DESIGN Mode main menu.
7. Create the graphics screen using the mouse and the PC Paint functions. Refer to the PC Paint user's manual on how to use the PC Paint.
8. When the graphics screen is complete, save the screen in the, E:\GRAPH\GRAPHxx, directory where 'xx' is the test level number of the current test question.

TEST Level number : _____

SECTION Type : _____
(Q for Q/Answer, S for Statement
or D for Dialog)

Section Question Number : _____

Stored in File : L_____.PIC

Brief description of the graphics screen: _____

_____

TEXT To Be Written On The Bit Map Using The PC Paint Fonts:

Text for Question (optional)
_____

_____

Text for answer 1 :
_____

_____

Text for answer 2 :

Text for answer 3 :

Text for answer 4 :

Attach any pictures or descriptions of any graphics to be included in the graphics screen.

A.5 Test Question Data Entry Form

Test Question Data Entry Form

Directions: Perform the following steps:

1. Fill in the test level number in the space below.
2. Fill in the section type in the space below.
3. Fill in the number of the question within the current Test Section.
4. Fill in the correct answer for the test question (i.e., '1').
5. Fill in if the test question can be repeated by the test taker.

To enter this data into the proper database: Perform the following steps:

1. Select the DBASE III Plus option on the DESIGN Mode main menu.
2. Load the proper LEVELx database into the DBASE III Plus editing environment and enter the information into the proper row of the database.

TEST Level number : _____

SECTION Type : _____
(Q for Q/Answer, S for Statement
or D for Dialog)

Section Question Number : _____

Correct answer is : _____

Can question be replayed? : _____

Appendix B

GLOSSARY OF TERMS

The following is a glossary of some of the terms used in this document.

database - is a file or group of files that store information that is organized in a row and column format.

data entry person - the individual who uses the DESIGN Mode of the system to record VOICE files to the system or who uses DBASE III Plus to enter data from the data entry forms to the various system database files.

dbase file - is a DBASE III Plus file that contains a database.

DIALOG section - is one of the three sections present at each testing level. The portions of speech heard in the DIALOG section is a dialog between two persons.

floppy disk - is a magnetized device that is contained in a metallic package, that is approximately 6 inches by 6 inches in size and can be inserted into a floppy disk drive that is a part of the IBM PC/XT. Floppy disks can be used to store information that is readable by the computer.

directory - is a repository provided by the DOS operating system to store files.

DOS - is the software that operates the PC/XT. Without DOS installed on the PC/XT, the PC/XT can not be used.

graphics artist - the individual who creates the GRAPHICS files using PC Paint.

graphics file - is a file created using PC Paint and contains the information necessary to display a graphics screen from **within** PC Paint.

harddisk - an electronic device that stores information readable by a computer on a spinning magnetic disk. The disk is permanently installed in the computer and can also be referred to as a 'fixed disk'.

mouse - a device that is held in the hand while using the PC/XT which allows the selection of objects on the computer display.

'question portion of test question' - the speech part of a test question that is played after the 'statement part' and contains the question that the test taker must answer.

QUESTION section - is one of the three sections present at each testing level. The portions of speech heard in the QUESTION section have two questions.

programmer - the individual who writes and maintains the system software using the system design specification as the ultimate guide in doing so.

potentiometer - an electronic switch that provides a way to control the amount of current passing through the device.

ram disk - an electronic device in the shape of a board, 4 inches by 11 inches that is placed inside the PC and can be used to create an additional logical drive for the PC/XT. All contents of the ram disk are lost when the PC/XT is turned off.

'statement portion of test question' - the speech part of a test question that is played first during the execution of a test question.

STATEMENT section - is one of the three sections present at each testing level. The portions of speech heard in the STATEMENT section have two statements.

test designer - the individual who maintains the system design specification.

test taker - the individual taking the listening comprehension test.

test supervisor - is the individual who may be with the test taker during test execution to provide assistance.

PC/XT - a computer manufactured by IBM.

voice board - an electronic device in the shape of a board, 4 inches by 11 inches that is placed inside the PC and provides additional functions for the PC/XT to record speech with a microphone or tape recorder, and play pre-recorded speech using a speaker or headset.

voice file - is a file created by the IBM Communication Option device; the file contains the digitized representation of voice recorded using a microphone or input from a tape recorder.

Appendix C

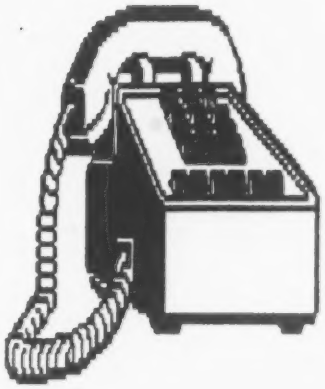
ESL SCREENS (SELECTED SAMPLE)

The following are samples of screens for the ESL test.

L3DG1QA

Directions: You will hear a question. Then you will read several answers to the question on your screen. Choose the appropriate answe to the question you hear.

For example, you will hear the question:



BEST COPY AVAILABLE

L3DG1CB

Then you will read on your screen:

(1) Yes, it is.

(2) No, it isn't.

The appropriate answer to the question, "Is this a telephone," is "Yes, it is." So, press key #1. Good.

Let's continue.

L3G1Q

Listen for the question:

(1) Yes, it is.
(2) No, it isn't.

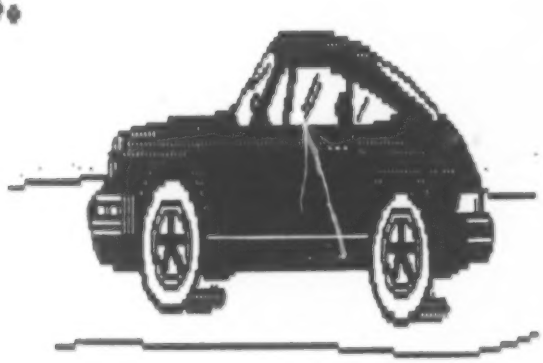
BEST COPY AVAILABLE

L3G2Q

Listen for the question:

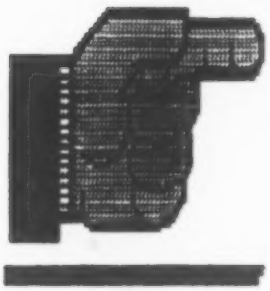
(1) Yes, it is.

(2) No, it isn't.



BEST COPY AVAILABLE

3G3B



Listen for the question and answer.

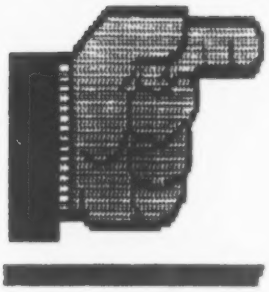
The answer is

(1) appropriate

(2) not appropriate

BEST COPY AVAILABLE

L3G5B



Listen for the question and answer:

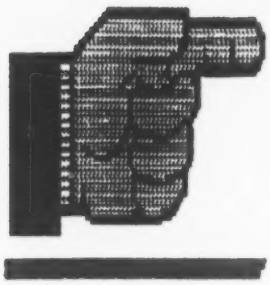
The answer is

(1) appropriate

(2) not appropriate

BEST COPY AVAILABLE

L3G6Q



Listen for the question and answer.

The answer is

(1) appropriate

(2) not appropriate

L3DG1DA

Directions: You will listen to a short conversation between 2 people. Then you will hear some questions about the conversation. Listen to each question and then choose the appropriate answer to the question you hear.

For example: You will hear a conversation at an airport:

L3PG'PB

Listen to a question about the conversation:
Then select the appropriate answer:

(1) Yes, she is.
(2) No, she isn't.

The appropriate answer is "No, she isn't. She's at an airport." So, press key #2. Good.

L3DG1DC

Here's another question ?

Select the appropriate answer:

It arrives _____

(1) in the morning

(2) at night

The plane arrives at 10 o'clock in the morning.
So, press key #1. Fine.

Are you ready to begin?

L3G1D

Listen to a young man talking **about** himself:

Listen to the first question about the young man, then select the appropriate answer: ?

(1) David
(2) New York

L3G2D

Listen to the second question about the young man, then select the appropriate answer:

(1) Yes, he is.
(2) No, he isn't.

L3G3D

Listen to the third question about the young man, then select the appropriate answer:

(1) Yes, he was.
(2) No, he wasn't.

L3G4D

Listen to the fourth question about the young man, then select the appropriate answer:

(1) Yes, a lot.
(2) No, not much.

L4DG1QB

You will read on the screen:

(1) About 3 days.
(2) My stomach hurts.
(3) I have a temperature of 102 degrees.

The appropriate answer to the question, "How long have you had the temperature?" is **#1** "About 3 days." Press key **#1**.

All right. Let's continue.

L4G1C

You are in a doctor's office. The nurse is asking questions.

Listen for the first question, then choose the appropriate answer: ?

(1) I have a temperature.
(2) I need an aspirin.
(3) I'm fine, thanks.

L4 G >Q

Listen for the second question, then choose the appropriate answer: ?

(1) Yes, my arm hurts.
(2) Yes, my throat is sore.
(3) Yes, I saw the nurse.

L-G-36

Listen for the third question, then choose the appropriate answer: ?

(1) Yes, I feel sick.
(2) No, I can't eat much.
(3) For about a week.

L4G4S

Listen for the fourth question, then choose the appropriate answer: ?

(1) Yes, my back aches a lot.
(2) Yes, I can come back tomorrow.
(3) No, I didn't break my arm.
(4) No, I didn't have a temperature.

L4 DG 50 B.

You will read on the screen:

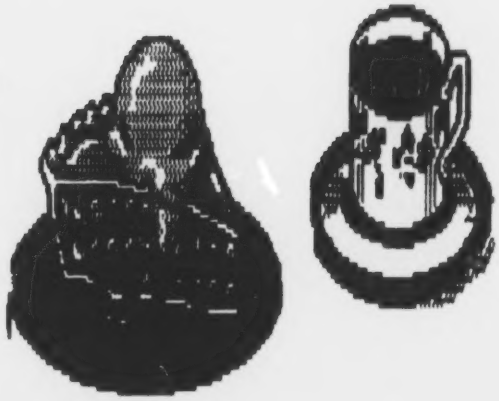
(1) Yes, I'm ready to order.
(2) Waiter, I'd like a table for two.
(3) Thank you, I'd like to have the check.

The appropriate answer to the question, "Are you ready to order," is **(1)**, "Yes, I'm ready to order."

Ok, let's continue.

L4650

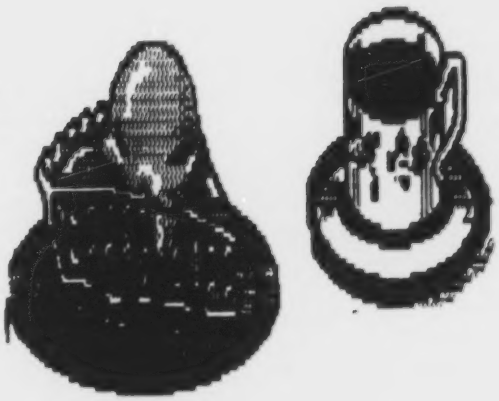
Listen for the question,
then choose the
appropriate answer:



(1) I'd like tea.
(2) I'd like it after dinner.
(3) I'll take coffee with cream.

L4G6C

Listen for the question, then choose the appropriate answer:



(1) The baked fish.
(2) Green beans and corn.
(3) Chocolate cake and ice cream.

LADOISA

Directions: You will hear a number of statements. After you hear each statement, you will read 3 or 4 sentences on the screen. Decide which of the sentences is CLOSEST IN MEANING to the statement you heard.

Listen to an example:

A woman is in a restaurant. She is ordering breakfast. She is talking to the waiter. You will hear her tell the waiter:

L4 DG 1 SB

The woman is ordering _____ juice.

(1) apple
(2) orange
(3) tomato

The woman is ordering ORANGE juice. So, press key #2.

All right, let's continue.

L4DG1DB

Listen to the question, then choose the BEST answer: ?

(1) chicken
(2) steak
(3) shrimp

The appropriate answer to the question, "What does the woman order" is **#1**, "Chicken". So, press key **#1**.

All right, let's continue.

L4G35

Listen to the statement:

The woman ordered _____.

man

(1) a beverage
(2) a dessert
(3) an appetizer
(4) a main dish

BEST COPY AVAILABLE

L4 G3 D

Listen to the question, then choose the BEST answer: ?

(1) Yes.
(2) No.
(3) We don't know.

L5G2Q

Listen for the question ?

(1) No, I'd like peas and carrots.
(2) Yes, we're ready to order.
(3) Waiter, this knife is dirty.
(4) No, thanks. Just bring the check, please.

BEST COPY AVAILABLE

L5Q3a

Listen for the question: ?

(1) No, I'd like peas and carrots.
(2) No, thanks. Just bring the check, please.
(3) Yes, we're ready to order.
(4) Waiter, this knife is dirty.

BEST COPY AVAILABLE

L5G1S.

Listen to the statement.

The speaker is _____.

(1) in class
(2) at a party
(3) at the airport
(4) in a restaurant.

BEST COPY AVAILABLE

L5G03

Listen to the statement: !

The speaker is _____.

(1) in class
(2) at a party
(3) at the airport
(4) in a restaurant.

BEST COPY AVAILABLE

L50G55

Directions: You will listen to a number of statements. You must decide what mood the speaker is in when he makes the statement.

For example, you will hear:

L5G3S

Listen to the statement: !

The speaker is _____.

(1) sad
(2) happy
(3) angry

BEST COPY AVAILABLE

L5G55

Listen to the statement: !

The speaker is _____.

(1) sad
(2) happy
(3) angry

L5G1D

Listen to the following conversation.

The food is _____.

(1) good
(2) bad

BEST COPY AVAILABLE

L5G2D ?

Listen to the following conversation: !

The prices are _____.

(1) expensive
(2) inexpensive

L6DG123

You will read on the screen:

(1) She's out of danger.
(2) At around midnight.
(3) It was raining.
(4) It was snowing.

The correct answer to the question, "When did the accident occur" is **(2)** "At around midnight."
Press key **#2.**

All right. Let's continue.

BEST COPY AVAILABLE

L6G:Q

Listen to the first question: ?

Yes, _____.

(1) her sister was with her.
(2) she was alone in the car.
(3) the doctor says she is fine.
(4) the police arrived on the scene right away.

L6G3Q

Listen to the third question ?

Yes, _____.

(1) she will be in the hospital for 2 weeks.
(2) the weather was bad that night.
(3) she broke her left leg.
(4) her sister is fine.

L6Q4Q

Listen to the fourth question: ?

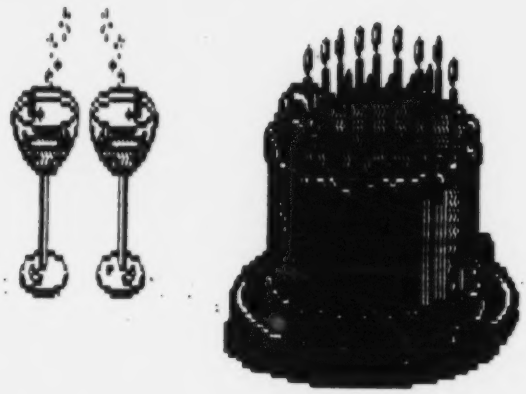
(1) She will be in the hospital for 2 weeks.
(2) The weather was bad that night.
(3) She broke her left leg.
(4) Her sister is fine.

BEST COPY AVAILABLE

L6DG5QA

Directions: You will listen to several questions, and then you will select the choice that matches the question you heard.

For example, you will hear:



L6G5Q

Listen to the question: ?

(1) Does he think it's right to leave?

(2) Do you think it's all right to leave?

BEST COPY AVAILABLE

L6DG1SA

Directions: You will listen to a sentence that contains some pauses and corrections of mistakes on the part of the speaker. Listen to the sentence and then select from the choices (1), (2), (3), or (4) the response that completes the statement on the screen.

For example, you will hear:

Appendix D

ESL ITEMS TAPE SCRIPT

Level 3

Questions & Answers

Directions: You will hear a question. Then you will read several answer to the question on your screen. Choose the appropriate answer to the question you hear.

For example, you will hear the question

Is this a telephone? (Graphic of telephone on screen + answers)

Then you will read on your screen

(1) Yes, it is.

(2) No, it isn't.

The appropriate answer to the question, "Is this a telephone?" is "Yes, it is." So press key #2. Good.

Let's continue.

****

Listen for the question.

Is this a animal? (Graphic of baby + answers)

Listen for the question.

Is this a house?

Directions: You will listen to a question. Then you will immediately hear an answer to that question. If the answer is an appropriateanswer to the question, press key #1, It is is not, press key #2.

For example, you will hear the question:

How old are you?

M2: I live in New York.

You will read on the screen:

The answer is

(1) appropriate

(2) not appropriate

The man's answer, "I live in New York" is not an appropriateanswer (or response) to the woman's question, "How old are you?" So, press key #2.

Here's another example. You will hear the question,

How old are you?

I'm 25 years old.

You will read on the screen:

The answer is

(1) appropriate.

(2) not appropriate.

The man's answer, "I'm 25 years old" is an appropriaterespons to the question, "How old are you?"

All right. Let's continue.
****

Level 4

Questions & Answers

Directions; When you don't feel well, you go to the doctor. You will listen to some questions a doctor or nurse might ask a sick person. Listen to the question, and then choose the correct answer from the choices (1), (2), (3), or (4) on the screen.

For example, you will hear the nurse ask:

How long have you had the temperature?

You will read on the screen:

(1) About 3 days.

(2) My stomach hurts.

(3) I have a temperature of 102 degrees.

The correct answer to the question, "How long have you had the temperature?" is (#1) About 3 days. Press key #1.

All right, let's continue.

You are in a doctor's office. The nurse is asking questions. Listen for the questions:

What's the matter with you?

Listen for the question:

Do you have a sore throat?

Listen for the question:

How long have you been sick?

Listen for the question:

Does your back ache?

You are in a restaurant. You are hungry and thirsty, and you want to order a meal. The waitress is asking you some questions. You will listen to the questions and choose the correct answers to the questions you hear.

For example, you will hear:

Are you ready to order?

You will read on the screen:

(1) Yes, I'm ready to order.

(2) Waiter, I'd like a table for two.

(3) Thank you, I'd like to have the check.

The correct response to the question, "Are you ready to order?" is (1), "Yes, I'm ready to order."

Ok, let's continue.

Listen for the question:

Would you like coffee after or with your dinner?

Listen for the question:

What would you like for dessert?

****

Understanding Statements

Directions: You will hear a number of statements. After you hear each statement, you will read 3 or 4 sentences on the screen. Decide which of the sentences is CLOSEST IN MEANING to the statement you heard.

Listen to an example:

A woman is in a restaurant. She is ordering breakfast. She is talking to the waiter. You will hear her tell the waiter:

Waiter, bring me a glass of orange juice, please.

You will read on the screen:

The woman is ordering _____juice.

(1) apple

(2) orange

(3) tomato

The woman is ordering ORANGE juice, not apple or tomato, so press key #2.

All right, let's continue.

A man and woman are in a restaurant. It is dinner time. Listen to the man and woman's order.

Listen to the statement:

I'd like the chicken and rice dish, no salad.

Listen to the statement:

I'll have the fish, a green salad, and peas.

Listen to the statement:

Hmmmm. Pie and ice cream. I'll take that.

Understanding Dialogs:

Directions: You will hear a number of short conversations between a man and a woman. At the end of each conversation, I will ask a question about the conversation. Listen to the question. Then read the 3 or 4 possible answers to the question that are on the screen. Choose the best answer to the questions, and press key # (1), (2), (3), or (4).

Listen to the following conversation between a man and a woman in a restaurant:

What are you going to order?

I think the broiled chicken and french fries look good. What about you?

I think I'll order the steak and a baked potato.

Question: What does the woman order?

The correct answer to the question, "What does the woman order?" is #1, "Chicken." Press key #1.

All right, let's continue.

Understanding Statements:

Listen to the following conversation between a man and a woman in a restaurant:

Wow, Look at the prices! This place is expensive.

Yes, but the food is so good.

It's $22.00 for a steak dinner.

Yeah, but it only costs $12.95 for the baked fish.

Let's order the fish.

Fine.

Question: How much does it cost to order the steak dinner for 2 people?

Question: Does the woman order the fish, too?

Script

Level 5

Questions & Answers

Directions: On your screen you see 4 answers to questions a waiter or waitress might ask people who are in a restaurant. Listen to each question and choose the correct answer to the question you hear. Press Key # (1), (2), (3), or (4) to choose the BEST answer to the question you hear.

Listen to an example:

You will hear the question:

How many for dinner? (Then choose the BEST answer to the question.)

(1) I'd like a table for two.

(2) I made the reservation this morning.

(3) We'd prefer a table near the window.

(4) The non-smoking section, please.

The BEST answer to the question, "How many for dinner?' is #1, "I'd like a table for 2 people." Press key #1.

All right, let's continue.

You are in a restaurant. Listen for the waiter's questions and choose the best answer to the question.

Listen for the question:

Yes? Is anything wrong?

Listen for the question:

Have you finished? Would you like dessert?

Listen for the question:

Would you like the corn?

Understanding Statements

Directions: You will listen to a number of statements. You must decide where the speaker is when he makes the statement.

For example, you will hear:

"Waiter, please bring me a glass of water."

You will read on the screen:

The speaker is _____.

(1) in class

(2) at a party

(3) at the airport

(4) in a restaurant

The speaker said, "Waiter, please bring me a glass of water. The word WAITER indicates that the speaker is in a restuarant. So press key #4.

Let's go on.

Listen to the statement:

I'd like a seat by the window.

Listen to the statement:

The test will be given next Friday.

Directions: You will listen to a number of statements. You must decide what mood the speaker is in when he makes the statements.

For example, you will hear:

Julia, guess what! I just found a hundred dollars! (happy)

You will read on the screen: The speaker is _____.

(1) angry

(2) happy

(3) sad

The speaker said, "_____." She is happy. So, press key #2.

Let's go on.

I told you to stop doing that right now! (angry)

I failed the test. It's not fair! I studied hard for that test. (angry)

I failed the test. I wish I had studied harder. (sad)

Understanding Dialogs:

Use Intermediate Listening Comprehension tape (Ability to infer situations).

Script - Level 6 Items

Questions

Directions: A man has just found out that his friend Mary was in a bad car accident last night. He is calling another friend, Bill, to find out some information about Mary. Listen to each question and then decide which of the 4 choices (1), (2), (3), or (4) is the best answer to the question you hear the man ask.

For example, listen to the first question:

When did the accident occur?

You will read on the screen:

(1) She's out of danger.

(2) At around midnight.

(3) It was raining.

(4) It was snowing.

The correct answer to the question, "When did the accident occur?" is (2) "At around midnight." Press key #2.

All right. Let's continue.

Was anyone else in the car when the accident occurred?

Was Mary badly injured?

Did she break any bones?

Why did the accident occur?

Directions: You will listen to several questions, and then you will select the choice that matches the question you heard.

For example, you will hear:

When did you get back from the party?

You will read on the screen:

(1) Who do you want to take to the party?

(2) When did you get back from the party?

Sentence #2 is the one you heard spoken. So press Key #2.

Do you think it's all right to leave?

Statements

Directions: You will listen to a sentence that contains some pauses and corrections of mistakes on the part of the speaker. Listen to the sentence and then select from the choices (1), (2), (3), or (4) the response that completes the statement on the screen.

For example, you will hear:

Hello? Tom, er, uhm, I mean Bob... has already left for work. You can reach him at his office in 40 minutes or so.

You will read on the screen:

The caller wanted to talk to _____.

(1) Tom

(2) Bob

The speaker started to speak about Tom but corrected his mistake. He knew the caller wanted to speak to Bob, not Tom. Press key #2.

Let's continue.

John started to fix errrr, not fix, EAT the vegetables. He was so hungry, he ate them raw.

I met Mary and her sister, ... (pause) I think it was her sister, mmmm, maybe it was her cousin... last night. They were on their way to a movie.

Directions:

You will listen to several statements, and you are to select from the choices (1), (2), (3), or (4) the sentence that is closest in meaning to the one you heard. Listen for the tone of the speaker's voice and any other clues that indicate the meaning of the speaker's message.

For example, you will hear the statement:

John, you TRIED to call me?! I waited for 3 hours for your call. Yeah, you TRIED to call me!

The speaker is _____ John.

(1) angry with

(2) happy for

(3) afraid of

(4) sad for

Let's continue.

John you ONLY received 99 out of 100 on that exam. You're so stupid!

Directions: You will listen to several sentences, and you are to select from the choices (1), (2), (3), or (4), the sentence on the screen which is closest in meaning to the one you hear.

For example, you will hear:

The important letter to Mr. Jones was mailed last night by my secretary William.

William _____ an important letter last night.

(1) wrote

(2) mailed

(3) received

Let's continue.

If John lost the 2 books, Mary, then he should have to pay for a replacement, not you or me.

Dialog

Directions:

You will listen to a conversation between a professor and her student. After listening to the conversation, you will indicate whether you heard certain information or not in the conversation.

For example, you will hear a conversation like the following:

M: Professor, can you tell ms when the final examination will be held?

W: It will be given on December 2nd between 9 and 11 in the morning. It will be given in this room, as a matter of fact.

M. Will it be an open-book exam?

W: Yes, you can bring your textbook and any notes to help you answer the questions.

M: Good. I'll need all the help I can get.

The correct answer #4. The professor did not say what the content of the exam would be. So press key #4.

All right, let's continue

Listen to this conversation between a bank teller and a customer:

M (Teller): Next, please.

W (Customer): I'd like to cash this check, and I'd like to get $1,500.00 worth of travellers checks. I'm going on vacation next week.

M (Teller): $1,500.00. In what denominations?

W (Customer): I'd like it in denominations of 50.

M (Teller): Fine. Here you are. You can sign the 30 checks at the table over there, and then come back when you're finished.

W (Customer): Fine. How much is the charge for the checks?

M (Teller): That'll be $10.00. You can pay after you've signed the checks.

W (Customer): Thank you very much.

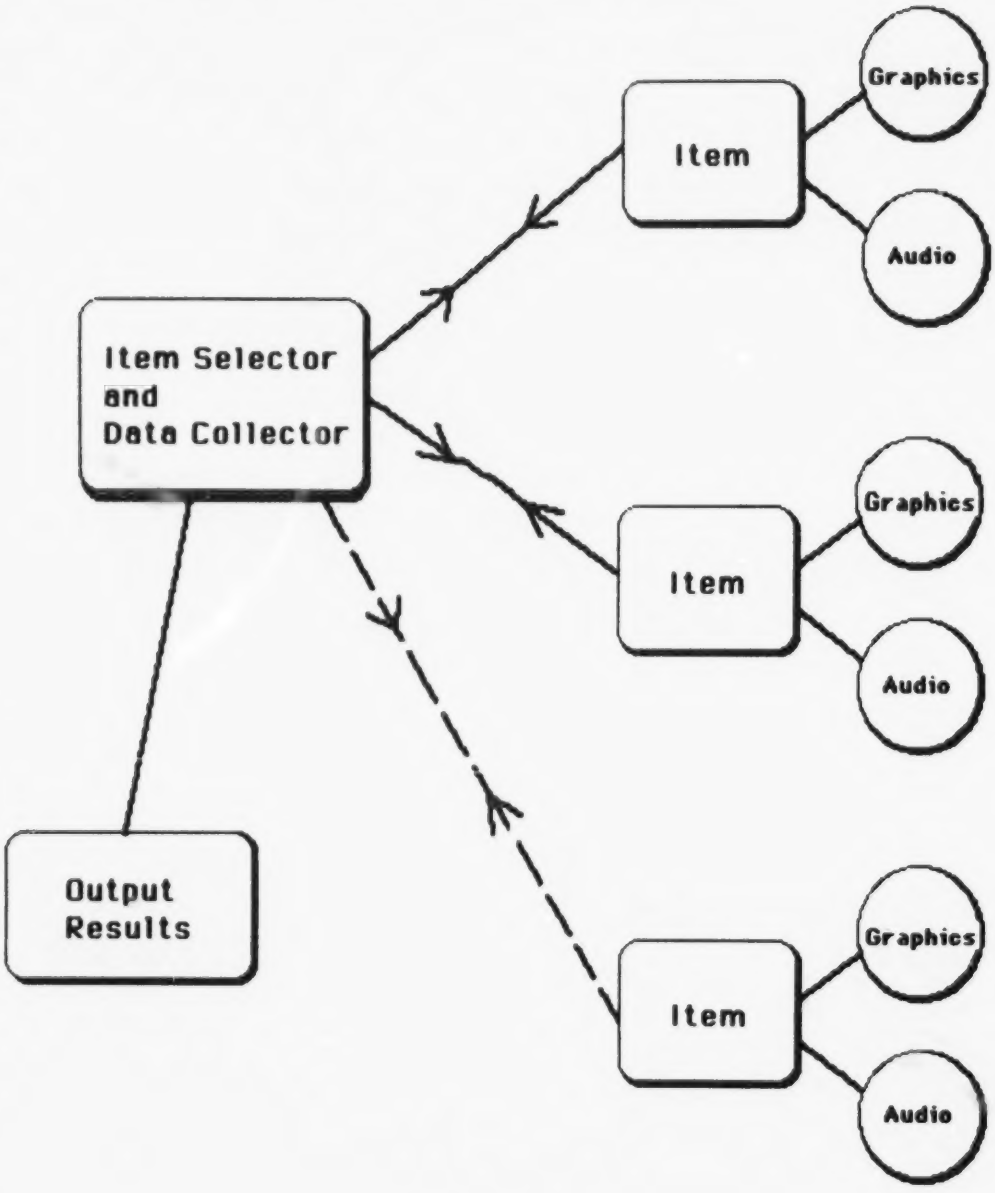
M (Teller): Next.

Appendix 2

The French Listening Comprehension Prototype

French Listening Test

Program Structure



Appendix

Technical Report by R. Ariew

This technical appendix contains the following sections:
1) **Display Characteristics** which provides details on the PC display and the text and graphics capabilities of the software. Included are screen shots of the display capabilities.
2) **Voice Storage and Retrieval**

a) **The IBM Voice Communications Option** which provides information on the capabilities of the hardware device and its software interface.

b) **The Antex Digital Audio Processing System** which discusses the hardware and software capabilities of that device.
3) **Test Item Samples** in which the ACTFL Guidelines for listening comprehension are excerpted and where several examples of test items for French are given. Included are screen shots of the test items.

Display Characteristics

Ariew's work had to take into account the display of foreign language characters, accents and type fonts, as well as the display of graphics on the microcomputer screen. A standard graphic display device, called the Color Graphics Adapter, is available for the IBM PC (or compatible) which will display any graphics, characters and/or line drawings. With the adapter, the resolution of the screen is 320 x 200 dots across the face of the screen, with four colors (medium resolution) or 640 x 200 in monochrome (high resolution). When displaying text, the medium resolution yields 40 column displays, while the high resolution mode allows for 80 column displays. Foreign language characters may be displayed in these graphics modes, thus allowing a free mixture of line drawings and shaded drawings along with text.

Software was designed and implemented to allow use of foreign language characters in medium and high resolution modes. In medium resolution, the text may take on color characteristics similar to those available for line drawings. In high resolution, only monochrome text is available. In both modes, text may be mixed with line drawings, shaded

drawings, or with colored drawings (in medium resolution). The software has additional capabilities which includes displaying double-sized characters in both modes, as well as inverse characters (black letters on a white background). Furthermore, all graphics modes may be accessed from BASIC, Pascal or C.

Several figures are provided at the end of this appendix which illustrate the screen design capabilities of the software. All figures provided are screen shots; that is, exact prints of what is displayed on a typical display screen. Figure 1 shows normal and inverse letters in regular size and double size in high resolution (80 column format). Figure 2 shows French and Spanish accents and special characters in high resolution. Figure 3 shows normal and inverse letters in regular size and double size in medium resolution (40 column format). Figure 4 shows French and Spanish accents and special characters in medium resolution. Figure 5 illustrates colored drawings with foreign scripts. Note that the printer shows colors as various shades of black. Figures 6 and 7 demonstrate the various graphics capabilities, including colored drawings and line drawings.

Voice Storage and Retrieval

a) The IBM Voice Communications Option

The IBM Voice Communications Option provides software with sample programs in BASIC. The software, entitled VOICE.BAS, allows for the recording and retrieval of voice files. Voice files may be easily accessed from within the user's program. This document, prepared by Antares of Tucson Arizona, provides information on the use of BASIC software written for the VCOM board from IBM.

The VCOM board furnishes the user with the capability to record and playback audio signals. The software described herein interfaces with the VCOM board to allow recording and playing at three different digitization rates. These are 28.8, 19.2 and 14.4 KHz.

Software Overview

The VCOM software provided is written for use with two different "dialects" of the BASIC language. This software does not interface with the VCOM board directly. It interfaces with a device driver. This in turn

interfaces with lower level voice routines. Thus, the VCOM software is split up into three major pieces. These pieces are layered in a hierarchical fashion one on top of another. The lowest layer is the Voice Communications Operating Subsystem or VCOS. The next layer is the character device driver CVSD.SYS. The topmost layer is a set of BASIC language routines. The lower two layers are provided by IBM. The topmost layer is software that is provided by Antares.

Voice Communications Operating Subsystem

The IBM Voice Communications Operating Subsystem (VCOS) provides and controls the functions of the IBM Voice Communications Adapter (VCOM). With appropriate supplemental software, VCOS can perform many different voice-related functions. The functions documented here relate only to the recording and playback of voice signals.

Loading VCOS is accomplished by running the terminate/stay resident program, VCAPIDRV.COM. Running this program loads various function set files into memory for later use. These files are the ones with the "AIC" file extension. The "/o"option of VCAPIDRV allows the user to specify the VCOS function sets that are to be loaded. The following is a list of the appropriate function set id numbers for audio record and playback:

8 is Audio Record at 28.8 KHz
9 is Audio Playback at 28.8 KHz
12 is Audio Record at 19.2 KHz
13 is Audio Playback at 19.2 KHz
14 is Audio Record at 14.4 KHz
15 is Audio Playback at 14.4 KHz

The following is an example of running VCAPIDRV. In this example, the machine is instructed to load function sets for record and playback at both 28.8 and 19.2 KHz (four function sets in all).

```
C> vcapidrv /o 8 9 12 13
```

CVSD.SYS - the character device driver

CVSD.SYS is a standard output character device driver. It supports all of the voice recording and playback algorithms of the VCOS software. It supports all hardware devices provided in the VCOS hardware. Its purpose

is to provide a simple interface between VCOS and most application languages. Commands can be sent to VCOS (and then to the VCOM board) via simple string output to the device driver. To use the device driver, the following statement should be added to the "config.sys" file:

device=\..path..\cvsd.sys [nn]

where [nn] indicates the size of the audio buffer to be allocated. The valid size is from 4 to 63K. Additionally, the VCOS voice function sets should be preloaded, for example:

C>vcapidrv /o 8 9

Strings output to the device driver can be both upper and lowercase. The '$' character indicates the end of the input string. There are many ways to pass commands to the device driver. An example in BASIC is provided below.

```
open "\dev\voa" for output as #1
ioctl #1,"speak,test,3,9$"
print #1,"speak,test2,2,13$"
close #1
```

To play back a voice file, one merely states:

"Speak,<file name>[,<volume>][,<fset id>]$"

where <file name> is the name of an audio file to play back.
<volume> is OPTIONAL. It indicates the volume of the playback. Range is from 0 to 9. Default value is 0.
<fset id> is OPTIONAL. It designates the function set id of a playback voice algorithm. The currently supported fset ids are 9 for cvsd 28.8;13 -- for cvsd 19.2;15 -- for cvsd 14.4. Default value is 9.

"Speak,voice$" would playback a file named "voice".

To record into a file, one states:

"Listen,<file name>[,<max silence>][,<fset id>]$"

where: <file name> is the name of the file is created to save audio data.
<max silence> is OPTIONAL. It designates the number of seconds of silence after which the recording is stopped. The range is 0 to 9 seconds. Default value is 4 seconds.
<fset id> is the function set id of a CVSD recording algorithm. 8 for cvsd 28.8; 12 for cvsd 19.2; 14 for cvsd 14.4 Default value is 8.

"Listen,test,5,12$" would record a voice message in file "test" using CVSD 19.2.

GW-BASIC Interface Routines

These high level interface routines are written for the GW-BASIC language. They interface with the CVSD.SYS device driver. They provide a capability to record to and playback from operating system files. The code for the GW-BASIC interface is in a file called "VCOM_GW.BAS." This file contains the code for the routines and extensive comments on its use.

The following provides details the use of the GW-BASIC interface package with a BASIC program. The user must first append the source file package to the end of the program that is to use the routines, making sure that there are no line number conflicts or variable name conflicts between the program and the package. Finally, within the program, one must set interface variables to desired values and issue calls to the package routines with GOSUBs.

Available Routines (GW-BASIC)

The routines available in the package are as follows:

50200 - Initialization of VCOM_GW and further routines
50300 - Play a file
Set "VF$" to the file to play
Set "VV%" to control the volume of playback

Set "VR%" to control the digitizing rate

50400 - Record a file

Set "VF$" to the file to record

Set "VT%" to control the terminating silence

Set "VR%" to control the digitizing rate

50500 - Control string output to CVSD.SYS

Set "VS$" to the string to output

50600 - Cleanup

50900 - Error Handling

Interface Variables (GW-BASIC)

Communication with the routines and the main program is done through the use of interface variables. The following is a description of the interface variables used:

a) File name: VF$specifies the filename to be used for playback or recording. This must be set for playback or recording. Any valid filename is allowed.

b) Digitizing Rate: VR%specifies the rate for playback and recording:

If VR% = 1 then the rate is 28.8 KHz

If VR% = 2 then the rate is 19.2 KHz

If VR% = 3 then the rate is 14.4 KHz

The default value for VR% is set to 1 in the initialization routine.

c) Miscellaneous: VT%specifies the terminating silence period used for determining the end of a recording. The valid range is 1 to 9. The default value for VT% is set to 4 in the initialization routine.

VV%specifies the volume uses during playback. The valid range is 1 to 9. The default value for VT% is set to 1 in the initialization routine.

VS$ specifies the string to be output to the VCOM device driver. This is normally set up by the recording and playback routines. One can, however call the output routine (50400) directly.

QuickBASIC Interface Routines

These high level interface routines are written for the QuickBASIC language. They interface with the CVSD.SYS device driver. They provide a capability to record to and playback from operating system files. The

source code for the QuickBASIC interface is in a file called "VCOM_QB.BAS." Two other files for use with QuickBASIC are provided: VCOM_QB.LIB and VCOM_QB.QLB. These two are compiled library versions of the QuickBASIC interface.

There are three different ways to use the QuickBASIC interface package. All of these ways use the same method for calling the subroutines contained in the interface package. The differences lie in the method of "attaching" the interface package to the application program. First, one can include the source code for the package with the program. Second, one can load the VCOM_QB.QLB quick library when QuickBASIC is loaded by using the following command line:

```
C>qb /l vcom_qb
```

Third, one can link other BASIC object files with VCOM_QB.LIB using the LINK.EXE DOS command.

Available Routines (QuickBASIC)

The following are the routines that are available in the QuickBASIC version of the interface package.

vcinit (no parameters) This routine initializes the VCOM QuickBASIC module. None of the other routines in the module will work unless this routine is called first.

vcplay(VF$, VV%, VR%) This routine plays a previously recorded file at the volume and rate selected. VF$ is a string specifying the file to play. Any valid DOS filename can be used. VV% is an integer that specifies the volume at which to play. Valid values are 1 through 9. VR% is an integer that specifies the rate at which to play. Valid values are: 1 = 28.8 KHz; 2 = 19.2 KHz; 3 = 14.4 KHz.

vcrecord(VF$, VT%, VR%) This routine records a voice message to a file with terminating silence and rate as specified. VF$ is a string specifying the file to record. Any valid DOS filename can be used. VT% is an integer that specifies the length of silence that terminates the recording. Valid values are 1 through 9. VR% is an integer that specifies the rate at which to record. Valid values are: 1 = 28.8 KHz; 2 = 19.2 KHz; 3 = 14.4 KHz.

b) The Antex Digital Audio Processing System

The Antex VP620E is a general purpose audio recorder/player. The drivers described here enable the programmer to control all the VP620E functions through high level subroutine calls. The routines, referred to as 'commands', are designed to be called from a high level language (eg. BASIC, Pascal, C). The drivers, once activated, run in background or simultaneously with the application. In other words, the program will not be suspended or have to wait until the speech file has played back completely, but will continue to execute after the command has been initiated.

Command Overview

Each command or subroutine has a 'command number'. All arguments before the command number are used to pass parameters to the routine. Parameters will be passed as string and integer type only and must be in the correct sequence as shown for the command. Syntax is very important on the command line, because there will be no errors generated during the compile process. Study the program example for the language you will be interfacing to.

Command Usage

The commands must be issued in a logical sequence for the VP620E to operate properly. The following is a typical command sequence to illustrate the order of commands sent to the VP620E driver. After installing the driver software, VP620ESE.EXE, and before issuing any functional commands, command one or Vpbegin must be invoked. This command need only be called once or after a Vpend command.

The next command issued will communicate to the driver the file you wish to record (Vpsetrec) or playback (Vpsetply). The file will be opened and the first block of speech data is read into the speech buffer.

The Vpstart command will immediately begin the playback or recording without a delay. Having a minimal delay is generally important at this time. However, if the start sequence delay is not terribly critical, then the Vpplay or the Vprecord may be more desirable. Conversely, the Vpstop command is used to stop the playback or recording.

The Vpstatus command is used to interrogate the driver software.

Vpstatus will return the state or mode, DOS errors, elapsed time, and overload status when recording.

Individual Command Description

The following are each of the commands used to control the VP620E. The command syntax will vary depending upon your language. (The examples below are in Basic.) Remember that all variables are integer and string type. Also, see the example program using your language.

[1] ---------- CALL VP620%(USEIO%,USEINT%,VPBEGIN%) ----------
Parameters: USEIO%= 280 hex (default) or 180 hex if [J1] is installed.
USEINT%= 2 [J4] (default), 3 [J3], or 4 [J2] for the hardware interrupt number.
VPBEGIN%= 1

This command is the first command issued to the VP620E. It informs the driver what I/O addresses and hardware interrupt to use. USEIO% is an integer value representing the base I/O address for the VP620 board; 280 hex = 640 decimal and 180 hex = 384 decimal. The hardware is reset and the interrupt is enabled.

[2] - CALL VP620%(FILE$,SAMPLE_RATE%,MONITOR%,VPSETREC%) -
Parameters: FILE$= speech file name (eg. "sp1.spc")
SAMPLE_RATE%= 0 for 8 Khz, 1 for 16 Khz
MONITOR%= 0 for audio output muted, 1 for audio output
VPSETREC%=2

This command is used to initiate recording of a speech file. Use this command before the Vpstart command. The monitor function is used to prevent audio feedback when recording with a microphone. The sample rate is the speed or resolution of capturing the audio signal. Choose 16 Khz for sampling sixteen thousand times per second for the best sound quality; and will consume 8k bytes per second of disk.

[3] ------ CALL VP620%(FILE$,SAMPLE_RATE%,VPSETPLY%) ------
Parameters: FILE$= speech file name (eg. "sp1.spc")
SAMPLE_RATE%= 0 for 8 Khz, 1 for 16 Khz
VPSETPLY%=3

This command is used to initiate playback of a speech file. The filename specified is loaded into memory and waits for a Vpstart command to commence playback. If the Vpsetply command is called again and the previous file is still playing, then the new file will wait till the previous one has finished. This is referred to as 'word stringing'. The Vpsetply command may be called in rapid succession with the filenames to be strung together. Note error number 98.

Another method for specifying files to be strung together is to separate them with commas in FILE$. To play sp1.spc and sp2.spc together would look like this: FILE$="sp1.spc,sp2.spc".

String Edit Option

To play back a certain piece of a file, you may specify start and stop time intervals. The stop time is optional, the file will play from the start time given to the end of the file. The start time must always be smaller than the end time! The syntax is filename/ssss.hh/ssss.hh. The 'ssss' part is seconds and the 'hh' part is hundredths of a second (same format as the silence parameter). All fields must be filled with zeros. The times are referenced to the start of the file, being /0000.00. Here are some examples:

Play at start time= 1 second to end time= 2 seconds.
call vp620("sp1.spc/0001.00/0002.00",sample_rate,vpsetply)

Skip the first 3 seconds of the file.
call vp620("sp1.spc/0003.00",sample_rate,vpsetply)

Silence Option

There is a reserved filename, S, which is used to insert silence between files to be strung together. The S filename is assigned the number of seconds and is a six digit field (not including the decimal point)- "S=ssss.hh". All fields must be filled with zeros if not used. Resolution is one hundredth of a second. See The Silence Parameter section for examples.

[4] ---------- CALL VP620%(VPSTART%) ----------
Parameters: VPSTART%=4

This command begins a recording or begins playing the file

specified using the Vpsetrec or Vpsetply command.

[5] ---------- CALL VP620%(VPSTOP%) ----------
Parameters: VPSTOP%=5

While recording, use this command to stop the recording and close the file; and while playing, use this command to stop the playback.

[6] CALL VP620%(STATE%,DISK_ERROR%,SECONDS%,HUNDREDTHS_SECOND%, OVERLOAD%,VPSTATUS%)
Parameters: STATE%= 0 for idle
1 for playing
2 for recording
3 waiting to play
DISK_ERROR%= 2 File not found (see DOS technical reference)
= 3 Path not found
= 4 Too many open files
= 5 Access denied
= 6 Invalid handle
= 8 Insufficient memory
= 11 Invalid format
= 15 Invalid drive
= 18 No more files
= 98 File string buffer full
= 99 Hardware interrupt [IRQ2] not responding
SECONDS%= elapsed seconds since Vpstart command
HUNDREDTHS_SECOND%= hundredths second
OVERLOAD%= 0 for normal recording level, 1 for overload
VPSTATUS%=6

The Status command is used to monitor the VP620E during record and playback modes and to check for file opening errors. During recording, the Overload variable should be monitored to check for proper recording levels. Recording levels should be made near the point of Overload to make use of the full dynamic range of the VP620E.

Sometimes when using extensive file stringing, you will get a Disk_error equal to 98. This is okay. It means you exceeded the file string

block size and will have to issue the last Vpsetply again until you don't get an error.

Disk_error equal to 99, after calling Vpbegin along with a ten millisecond delay, may be used to determine whether the VP620E board is installed and responding to hardware interrupts (IRQx) requests on the I/O channel. It may be necessary to change the jumper configuration to avoid any conflicts with any other peripheral boards.

The elapsed time variables may sometimes seem to skip increments if your program cannot call the status command fast enough. This is especially noticeable in interpreted Basic.

[7] ---- CALL VP620%(FILE$,SAMPLE_RATE%,MONITOR%,VPRECORD%) ----
Parameters: FILE$= speech file name
SAMPLE_RATE%= 0 for 8 Khz, 1 for 16 Khz
MONITOR%= 0 for audio output muted, 1 for audio output
VPSETREC%=7

This function is a combination of functions Vpsetrec and Vpstart. Use this one if timing is not critical.

[8] --------- CALL VP620%(FILE$,SAMPLE_RATE%,VPPLAY%) ---------
Parameters: FILE$= speech file name
SAMPLE_RATE%= 0 for 8 Khz, 1 for 16 Khz
VPSETPLY%=8

This function is a combination of functions Vpsetply and Vpstart. Use this one if timing is not critical.

[9] ---------- CALL VP620%(VPEND%) ----------
Parameters: VPEND%=9

This command will always be your last command issued to the VP620E. Use this command before exiting your application so that interrupts will be released and the VP620E is left in the reset state.

[10] ---------- CALL VP620%(CUTOFF%,VPSETFILTER%) ----------
Parameters: CUTOFF%= new filter load value
VPSETFILTER%=10

The Cutoff variable is saved for the current sample rate. The defaults are 37 hex for 8Khz and 3A hex for 16Khz. The Cutoff variable is loaded into the AMI S3528 Programmable Low Pass Filter chip during subsequent records and playbacks.

Preparing Word Files

Included on the driver disk is a utility program to automatically remove silence from a word file, named ARS.EXE. Silence is normally regulated with the S parameter in the Vpsetply command to achieve regularity. The ARS program has three input parameters and one optional silence threshold parameter. The syntax is:

ARS [sample_rate]K source_file destination_file, (silence_threshold)

The sample rate is 8K or 16K depending upon the sample rate the file was recorded with. The silence threshold is optional and is used to gain more control of removing silence. The default value for the silence threshold is 40. Usually, the range between 20 and 100 will work best depending upon your recording environment.

The word is displayed as a function of average energy and is scaled to fit within the display region. The silence threshold is plotted as a horizontal line and is used for reference in determining the next best silence threshold to use. The ARS program uses the first hundredth of a second for determining the silence level of the file. The program will only strip silence off of a single word file no longer than two seconds in length at a 16Khz sample rate.

Test Item Samples

The following are sample items for the French test. All items have been written according to the criteria specified in the ACTFL Proficiency Guidelines for Listening.

Novice Level

Novice-Low: Understanding is limited to occasional words, such as cognates, borrowed words, and high-frequency social conventions. Essentially no ability to comprehend even short utterances.

Novice-Mid: Able to understand some short, learned utterances, particularly where context strongly supports understanding and speech is clearly audible. Comprehends some words and phrases for simple questions, statements, high-frequency commands and courtesy formulae about topics that refer to basic personal information or the immediate physical setting. The listener requires long pauses for assimilation and periodically requests repetition and/or a slower rate of speech.

Novice-High: Able to understand short, learned utterances and some sentence-length utterances, particularly where context strongly supports understanding and speech is clearly audible. Comprehends words and phrases from simple questions, statements, high-frequency commands and courtesy formulae. May require repetition, rephrasing and/or a slowed rate of speech for comprehension.

Test item: Identifying Possessions
Directions: Press P to hear a word in French, then press A, B, C, or D to identify the possession described by the spoken word. You may press P several times to repeat the word.
Oral Cue: One of the following.
une bicyclette; une chaise; une calculatrice; une clé; un appareil-photo; une chaîne stéréo; un disque; une télévision; une cassette; une radio
Graphics: line drawings for a bicycle, a chair, a calculator, a key, a camera, a stereo system, a record, a television set, a cassette, a radio

See Figure 8 for a screen shot of a test item based on this example.

Test Item: Conversation with Learned Utterances
Directions: Select the sentence that best responds to the oral question.
Oral cue: One of the following:
Bonjour! Comment ça va?
Comment vous appelez-vous?
Où habitez-vous?
Quelle est votre profession?

Quelle est votre nationalité?
Text on the screen: Several of the following, with "foolers" included.
Ça va bien.
Je m'appelle Robert.
J'habite à Chicago.
Je suis étudiant.
Je suis américaine.

Test Item: Going Shopping
Directions: Select the drawing that best illustrates the spoken message. Press A, B, C, or D to indicate your answer. Press P to hear the message.
Oral cue: One of the following.
Je voudrais des bananes.
Je voudrais des carrottes.
Je voudrais du fromage.
Je voudrais des oignons.
Je voudrais des champignons.
Je voudrais des tomates.
Je voudrais des oranges.
Je voudrais une baguette.
Je voudrais du Perrier.
Je voudrais du poulet.
Graphics: Line drawing of several of the following.
bananas, carrots, cheese, onions, mushrooms, tomatos, oranges, French bread, Perrier mineral water, chicken

Intermediate Level

Intermediate-Low: Able to understand sentence-length utterances which consist of recombinations of learned elements in a limited number of content areas, particularly if strongly supported by the situational context. Content refers to basic personal background and needs, social conventions, and routine tasks, such as getting meals and receiving simple instructions and directions. Listening tasks pertain primarily to spontaneous face-to-face conversations. Understanding is often uneven; repetition and rewording may be necessary. Misunderstandings in both main ideas and details arise frequently.

Intermediate-Mid: Able to understand sentence-length utterances which consist of recombinations of learned utterances on a variety of topics. Content continues to refer primarily to basic personal background and needs, social conventions and somewhat more complex tasks, such as lodging, transportation, and shopping. Additional content areas include some personal interests and activities, and greater diversity of instructions and directions. Listening tasks not only pertain to spontaneous face-to-face conversations but also to short routine telephone conversations and reports over the media. Understanding continues to be uneven.

Intermediate-High: Able to sustain understanding over longer stretches of connected discourse on a number of topics pertaining to different times and places; however, understanding is inconsistent due to failure to grasp main ideas and/or details. Thus, while topics do not differ significantly from those of an Advanced-level listener, comprehension is less in quantity and poorer in quality.

Test Item: My family
Directions: Select the family which is best described by the recorded message. Press A, B, C, or D to indicate your answer. Press P to play the message.
Oral cue:

Bonjour, je m'appelle Lydie. J'ai une famille intéressante. J'ai un frère et une soeur. Mon frère s'appelle André et ma soeur s'appelle Evelyne. Mes parents sont supers. En fait, j'adore mes parents. Ma mère s'appelle Denise et mon père s'appelle Charles. Nous habitons dans un superbe appartement à Paris.

Text: Four families, with names of people and their relations. One of which is described by the oral text

Test Item: What Comes Next
Directions: Press P to hear a question in French. Then press A, B, C, or D to select the most appropriate response to the question.
Oral cue: One of the following.
-Quel temps fait-il?
-Tu vas bien?
-Comment est-ce que tu vas à la fac?

Text: One of the following, with others as "foolers."
Il fait beau aujourd'hui.
Ça va.
A pied.

See Figure 9 for a screen shot of a test item based on this example.

Test Item: Weather Reports
Directions: Select the drawing which is best described by the radio weather report. Press A, B, C, or D to indicate your answer, P to play the audio message.
Oral cue:
Voici notre bulletin météorologique pour aujourd'hui. Dans le Nord-Est, il fait nuageux. Au nord- Ouest, il pleut beaucoup. Dans le centre, il y a des orages violents. A l'Ouest, il fait beaucoup de vent. Dans les Alpes, il neige à haute altitude. Mais, dans le sud, il fait très beau et il y a beaucoup de soleil pour les touristes.
Graphics: Four weather maps with various legends about weather in different part of France. One of the maps bears legends as described by the audio cue.

Test Item: My Calendar
Directions: Select the calendar which is best described by the audio message. Press A, B, C, or D to indicate your answer, P to play the audio message.
Oral cue:
En général, le dimanche, j'étudie mes statistiques. Pour ça, je dois aller à la bibliothèque. Mais le matin, je commence avec le tennis. Aussi, je vais souvent au musée. De plus, j'ai fréquemment une invitation au restaurant avec des amis. Pour maintenir la forme, je vais aussi à la classe d'aérobic. Le dimanche, je vais souvent au cinéma. Juste avant le cinéma, je prends le dîner. Je vais aussi régulièrement à l'église. Et, souvent, je suis invitée à des cocktails.
Text: Four different calendar entries with one which is described by the audio cue.

Advanced Level

Advanced: Able to understand main ideas and most details of connected discourse on a variety of topics beyond the immediacy of the situation. Comprehension may be uneven due to a variety of linguistic and extralinguistic factors, among which topic familiarity is very prominent. These texts frequently involve description and narration in different time frames or aspects, such as present, nonpast, habitual, or imperfective. Texts may include interviews, short lectures on familiar topics, and news items and reports primarily dealing with factual information. Listener is aware of cohesive devices but may not be able to use them to follow the sequence of thought in an oral text.

Advanced-Plus: Able to understand the main ideas of most speech in a standard dialect; however, the listener may not be able to sustain comprehension in extended discourse which is propositionally and linguistically complex. Listener shows an emerging awareness of culturally implied meanings beyond the surface meanings of the text but may fail to grasp socio-cultural nuances of the message.

Test Item: A Radio Broadcast
Directions: You're about to hear the news on the French Radio. Select the headline which best describes the news you have heard.
Oral Cue:
Le défilé du 14 Juillet à Paris a attiré aujourd'hui des milliers de personnes sur les Champs Elysées pour faire honneur à nos différents corps d'armée. Des milliers de parisiens et de touristes se sont ensuite recueillis sur la tombe du soldat inconnu dont la flamme avait été ravivée par le Président de la République.
Text: Headlines such as the following.
Des touristes ont visité le tombeau du soldat inconnu.
Le Président de la République a serré la main des spectateurs.
Des milliers de spectateurs sont venus voir le défilé militaire pour la fête nationale française.

See Figure 10 for a test item based on this example.

Other Oral Cue:

Une valise piégée a explosé aujourd'hui à l'aéroport international Charles de Gaulle-Roissy. Cinq personnes ont été tuées et douze grièvement blessées. L'attentat à la bombe a été revendiqué par un groupe de terroristes palestiniens qui exigent la libération de Mohamed Khalil actuellement incarcéré à la Prison St Luc pour attaque à main armée.
Text: Headlines such as the following.
Mohamed Khalil a été arrêté après l'explosion.
Une valise piégée a explosé à l'aéroport de Roissy.
Il y a eu une attaque à main armée à l'aéroport international.

Other Oral Cue:
Tout un réseau de trafiquants de drogue à été démantelé par la police des stupéfiants. Ce réseau alimentait le Tout-Paris des arts, des lettres, de la presse, et du showbusiness. Plusieurs artistes très célèbres ont été mis en cause par l'un des leaders du réseau. Les personnes inculpées risquent jusqu'à 10 ans de réclusion criminelle.
Text: Headlines such as the following.
La police des stupéfiants a arrêté un artiste qui utilisait de la drogue à Paris.
Des artistes ont été jugés à 10 ans de réclusion criminelle pour usage de drogue.
La police des stupéfiants a démantelé un réseau de drogue où des artistes célèbres sont inculpés.

Superior Level

Superior: Able to understand the main ideas of all speech in a standard dialect, including technical discussion in a field of specialization. Can follow the essentials of extended discourse which is propositionally and linguistically complex, as in academic/professional settings, in lectures, speeches, and reports. Listener shows some appreciation of aesthetic norms of target language, of idioms, colloquialisms, and register shifting. Able to make inferences within the cultural framework of the target language. Understanding is aided by an awareness of the underlying organization structure of the oral text and includes sensitivity for its social and cultural references and its affective overtones. Rarely misunderstands but may not understand excessively rapid, highly colloquial speech or speech that has strong cultural references.

Test Item: The Interview

Directions: Press P to hear the audio message, then press A, B, C, or D to identify the best summary of the audio message.

Oral cue: Note this is a live recording of an actual unscripted interview.

-Si on vous demande une définition sur le même ton... ça arrive rarement qu'on vous demande ça...
-Oui, alors je dirais plutôt écrivain en précisant que ça n'implique pas chez moi du tout une idée de prestige, mais plutôt une idée de pratique. Disons que ma pratique est celle de quelqu'un qui prend plaisir à écrire. Donc je suis effectivement un écrivain de ce point de vue là.

Text:

L'homme interviewé n'aime pas les écrivains.
L'homme interviewé est un intellectuel.
L'homme interviewé est un ingénieur ou bien un technicien.

See Figure 11 for a test item based on this example.

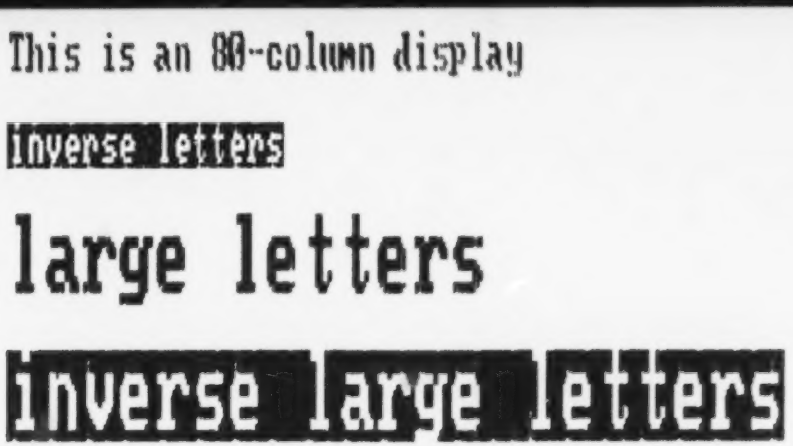


Figure 1 Normal and inverse letters in regular and double size, high resolution

BEST COPY AVAILABLE

Bonjour, c'est aujourd'hui le 1er février, 1988.

le bébé, le père, le maître, français, Noël

The lines above show all accents in French, displayed on an 80-col screen.

The line below shows the accent in Spanish, as well as special punctuation.

español, qué, ¡Hola! ¿Quien?

Press any key to continue

Figure 2 French and Spanish accents in high resolution

Figure 3 Normal and inverse letters in regular and double size, medium resolutio

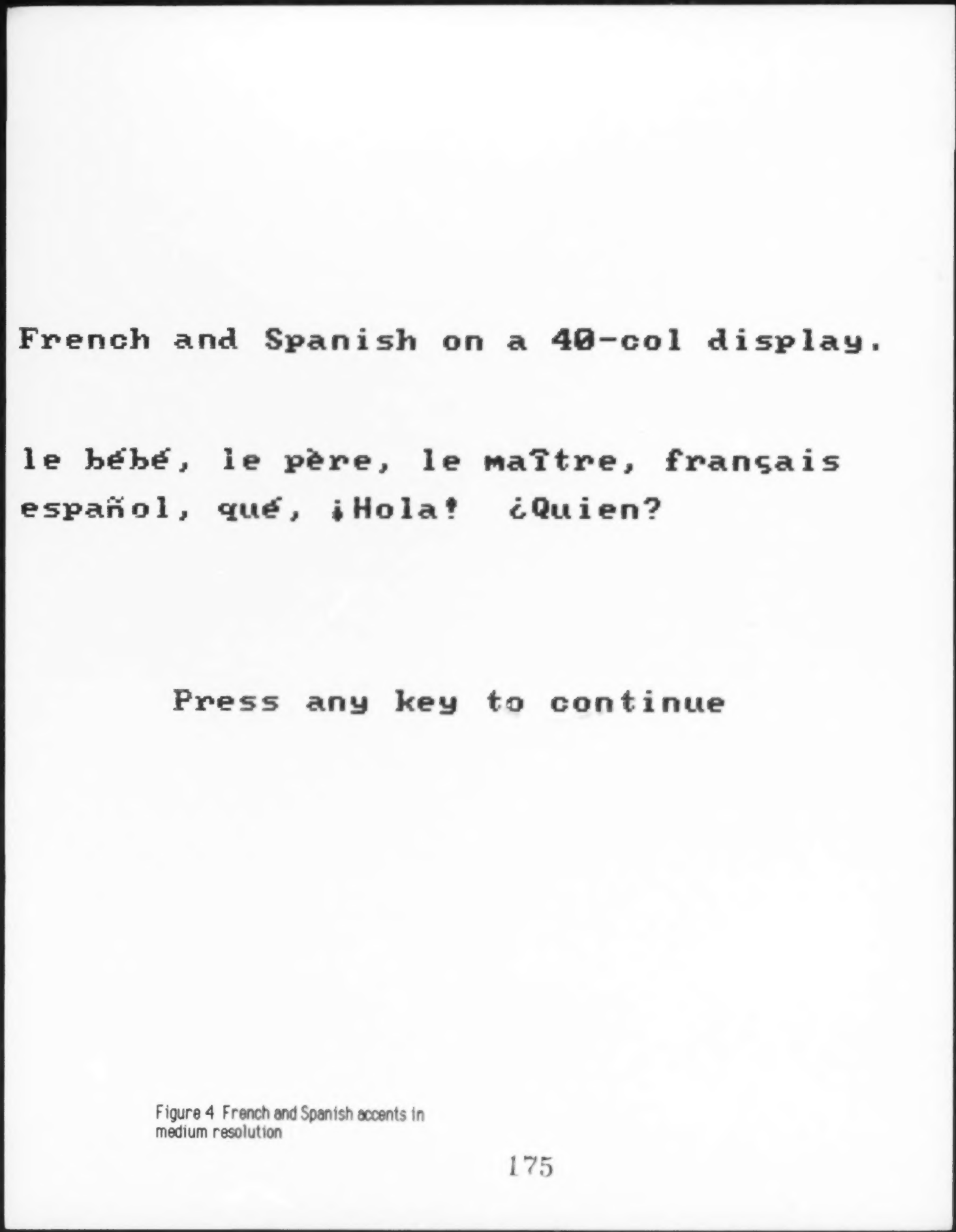
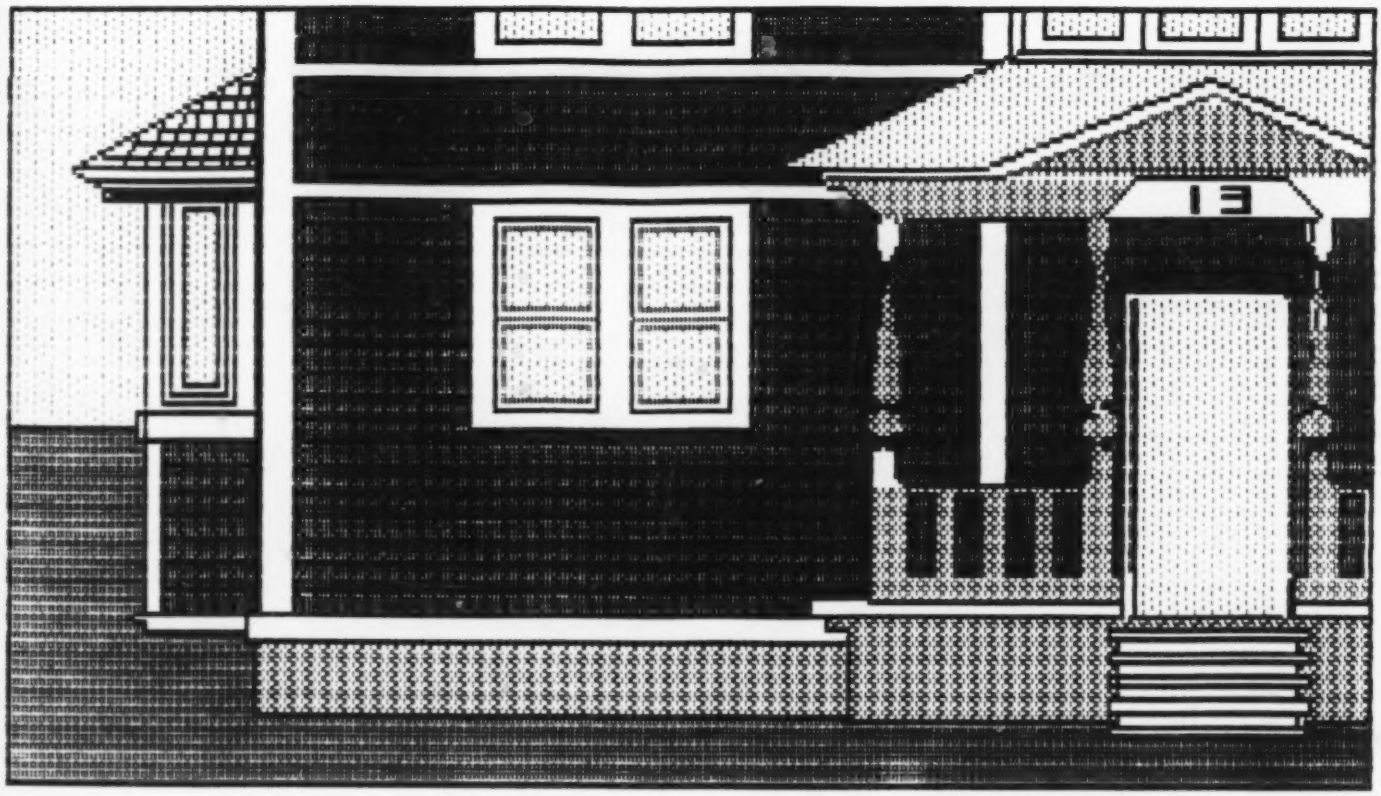


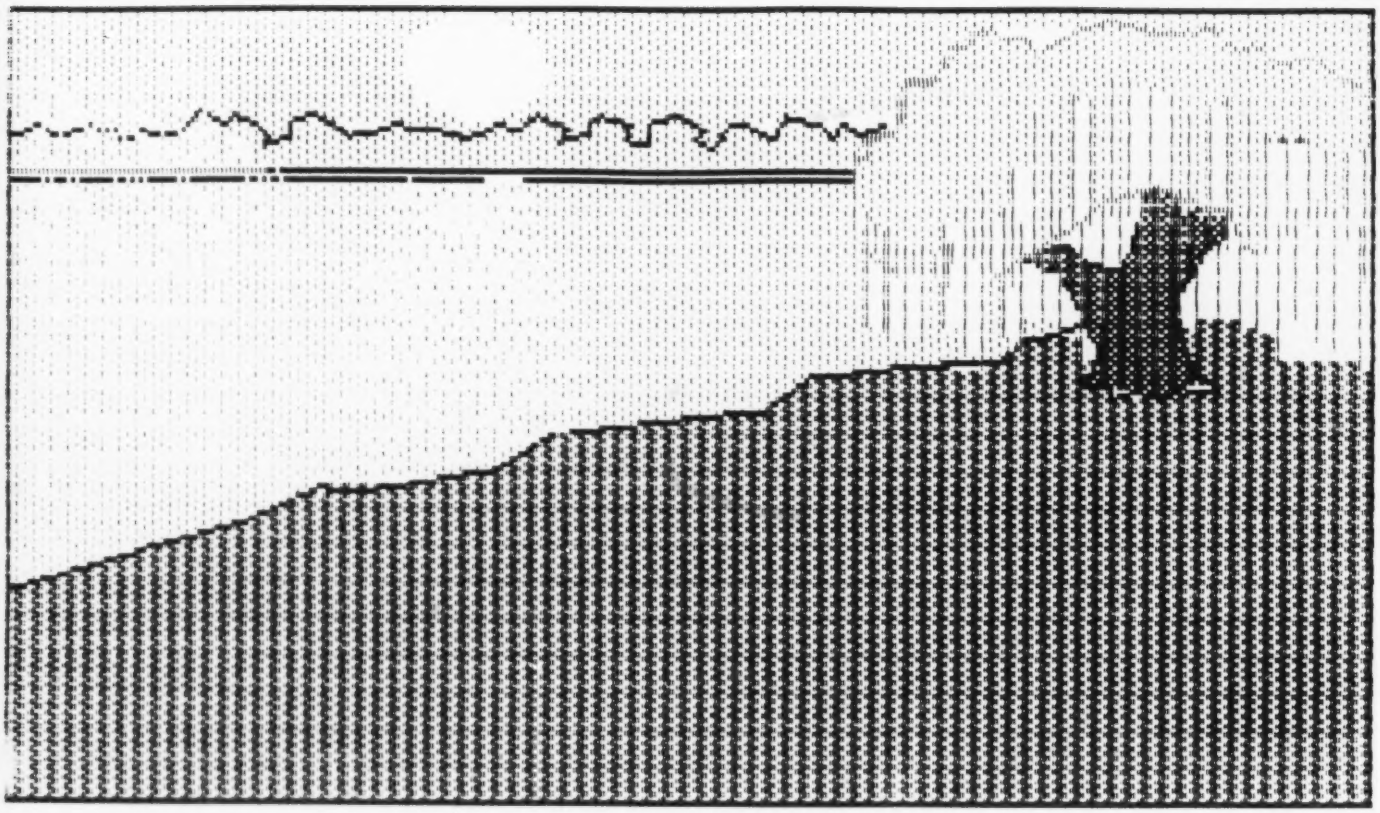
Figure 4 French and Spanish accents in medium resolution



Graphics and foreign scripts: ¡Hola! Hé!

Press any key to continue

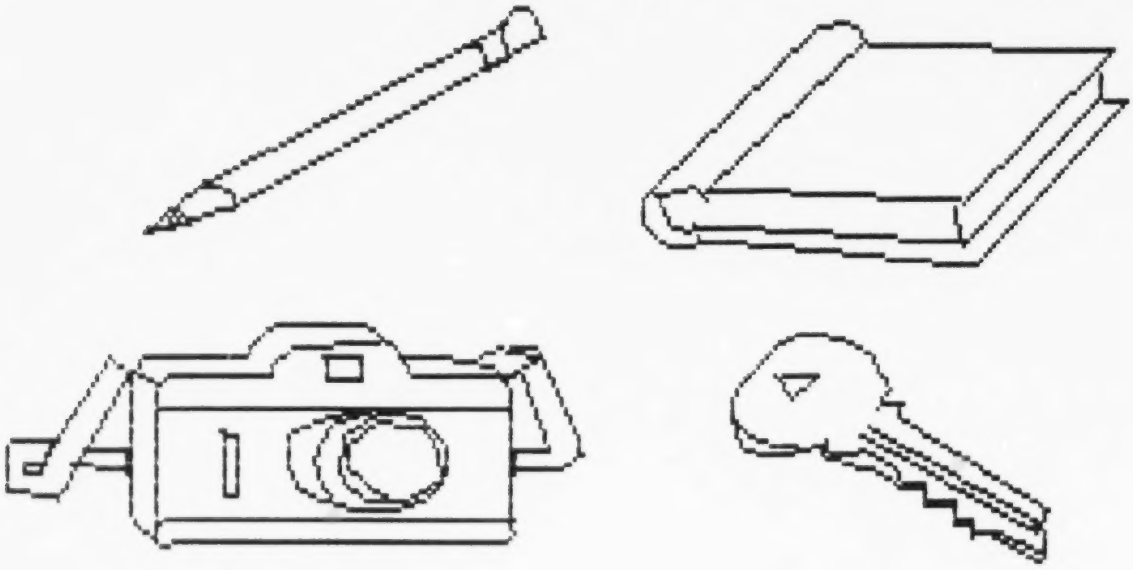
Figure 5 Colored drawing with foreign characters



Press any key to continue

Figure 6 Colored shaded drawing

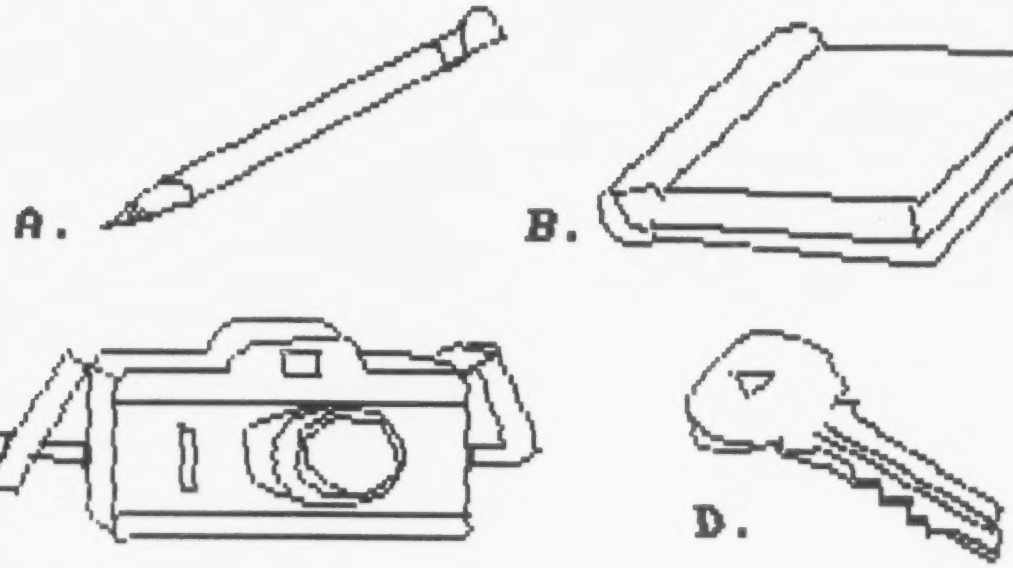
Individual Drawings



Press any key to continue

Figure 7 Line drawings

IDENTIFY THE SPOKEN WORD.
Press P to hear a word in French.
Then press A, B, C, or D to select the drawing described by the word.



P -> play; A, B, C, D -> answer.

Figure 8 Novice level item

WHAT COMES NEXT.
Press P to hear a sentence in French.
Then press A, B, C, or D to select the sentence you would use to respond.

A. Je voyage en voiture.

B. Très bien, merci.

C. Je suis américain(e).

D. Je suis étudiant(e).

A, B, C, D -> answer.

Figure 9 Intermediate level item

WHAT IS IT ABOUT?
Press P to hear a paragraph in French.
Then press A, B, or C to select the sentence that best sums it up.

A. Des touristes ont visité le tombeau du soldat inconnu.

B. Le président de la République a serré la main des spectateurs.

C. Des milliers de spectateurs sont venus faire honneur au président.

A, B, C, D -> answer.

Figure 10 Advanced level item

WHAT CAN YOU INFER?
Press P to hear a paragraph in French. Then press A, B, or C to select the statement that can be inferred from it.

A. *L'homme interviewé n'aime pas les écrivains.*

B. *L'homme interviewé est un intellectuel.*

C. L'homme interviewé est un ingénieur ou bien un technicien.

A, B, C, D -> answer.

Figure 11 Superior level item